



Methodological and Ideological Options

Effects of Bribery on Firms' Environmental Innovation Adoption in Vietnam: Mediating Roles of Firms' Bargaining Power and Credit and Institutional Constraints[☆]

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ABSTRACT

This paper uses survey data of small and medium-sized enterprises (SMEs) in Vietnam, from 2011 to 2015, to examine the effects of bribery on environmental innovation decisions by firms, accounting for the roles of bargaining power and/or credit and institutional constraints. In the study, bribery activities are categorized into greasing and rent-seeking forms. Self-assessment of firms on the uncertainty of government policies and the competition environment is used to capture institutional constraints, while firm size and legal registration status are used to represent bargaining power. The group of credit-constrained firms is further broken down into those that have demand for more loans and those not currently looking for a loan application. Our empirical results provide evidence that greasing bribery has a positive effect on firms' decisions about implementation of environmental innovation (the "greasing-the-wheels" hypothesis) while there is no impact from rent-seeking bribery. The positive effect of greasing bribery is particularly sizable for large, formally registered firms, or those facing no credit constraints, while specific types of institutional constraints that firms perceive as obstacles to their growth also affect the magnitude of the impact. Lastly, when endogeneity is controlled, the effect of greasing bribery becomes more pronounced and there is evidence on the "sanding-the-wheels" hypothesis of rent-seeking bribery.

1. Introduction

Increasing awareness of the importance of ecological and ethical responsibility raises pressure on firms to implement environmental innovations (EIs, henceforth). However, SMEs, which comprise the majority of firms, have little knowledge about environmental issues (Hillary, 2000), and generally encounter difficulties when integrating environmental considerations into their activities (Leistner, 1999). They are not sure how to use environmental management systems as a tool to improve profitability (O'Laoire, 1994) or to reduce environmental burdens (Rennings et al., 2003). Therefore, detailed guidance that helps SMEs to initiate environmental work has become extremely urgent.

Prior scholars define EIs as any novel product, process, or business model that reduces environmental risks, pollution, and other negative impacts of resource use, thus allowing firms to obtain a high level of environmental sustainability (Triguero et al., 2013). In the literature,

few studies have investigated the antecedents of EI at the firm level.¹ In particular, the role of internal factors (technology push), external factors (market pull), or environmental regulations (regulation push or pull), are examined in previous research (Horbach et al., 2012; Cuerva et al., 2014). Only a few papers, including Krammer (2014) and Nguyen et al. (2016), study the association between institutional idiosyncrasies like bribery and firms' general innovation. However, the effects of bribery on EI have remained silent thus far.

In developing economies characterized by prevalent government corruption, a less developed legal system (Cuervo-Cazurra, 2006), and low-salary public officials (Nguyen et al., 2015), bribery is affirmed as a common issue. As revealed by Zhou and Peng (2012), firms have little choice but to pay bribes, since bribery is widely acknowledged as an accepted norm (Nguyen et al., 2016) or the sole way to address the requests of public officials (Nguyen et al., 2020b). Bribing firms may be motivated by distinct reasons. Paying bribes may allow these firms to

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¹ The focus is paid to the individual firm since individual firms could generate negative externalities on the environment (Galdeano-Gómez, 2008).

access government contracts and resources or facilitate government activities (Nguyen et al., 2020a). The former is regarded as rent-seeking bribery, while scholars refer to the latter as greasing bribery. These two forms of bribery may cause diverse impacts on the economy.

Regarding the impacts of bribery, the conclusion on whether paying bribes hurts or helps firms is ambiguous in the literature. For example, evidence for the adverse effects of bribery on firm performance is provided by Fisman and Svensson (2007), while Dreher and Gassebner (2013) show that the adverse impacts of regulations on early-stage entrepreneurship may be tempered by paying bribes. Prior scholars also reveal that the costs and benefits of bribery may differ due to formal and informal registration (Nguyen et al., 2014) or firm size (Zhou and Peng, 2012). Regarding the two types of bribery, Nguyen et al. (2020b) demonstrate that greasing bribery positively impacts firm growth, while the effects of rent-seeking bribery depend on the ownership structure of a firm. Theoretical studies on an association between bribery and innovation are scarce. Moreover, these works also provide the competing so-called “sanding-the-wheels of innovation” and “greasing-the-wheels of innovation” hypotheses. More importantly, to date, there have been no studies that examine the effects of bribery on a specific form of innovation like EI.

This article aims to fill the gaps in the literature by investigating the relationship between bribery and EI decisions. Further analysis distinguishing the influences of rent-seeking and greasing bribery is also provided. Moreover, we build our hypotheses on the mediating roles of a firm’s bargaining power, credit constraints, and institutional constraints. Regarding bargaining power, based on a discussion by Nguyen et al. (2020b), we assume that a firm’s capacity and its alternatives to bribing determine its bargaining power. Accordingly, we use firm size and legal registration status to capture firms’ bargaining power. As argued by Bliss and Tella (1997), and Zhou and Peng (2012), firms must pay bribes for survival if they have weak bargaining power. Conversely, firms with strong bargaining power may gain more benefits from bribing (Rose-Ackerman, 1978). Regarding financial constraints, in this study, we draw from two popular strands of the literature on firm development: (i) on the link between financial accessibility and innovation (Amore et al., 2013; Brown et al., 2010; Hall and Lerner, 2010); and (ii) on the effect of bribery as a tool to alleviate the issues of securing credit (Weill, 2011; Wellalage et al., 2019). We argue that the inconsistency in the literature regarding the effect that bribes have on firms’ financial constraints results from a lack of clarity on the different forms of bribe – rent-seeking bribes and greasing bribes. We propose that from the perspective of a firm, being financially constrained would reduce the magnitude of the effect that greasing bribes have on environmental innovation. Following the model from Casey and O’Toole (2014), we also employ several variables to distinguish between the different forms of financial constraints. Regarding institutional constraints, there are two opposing predictions from extant theories. On the one hand, EI activity refers to a complex task (Dermody and Hammer-Lloyd, 1996), and innovative firms may face a greater demand for bribes (Fisman and Svensson, 2007) generated by public officials in areas with weak and poor institutions. Hence, firms have fewer resources for EI activities. On the other hand, scholars such as Leff (1964) and Leys (1965) suggest that bribery of public officials is referred to as the oil that “greases the wheels of innovation” in the case of weak and inefficient institutions. Therefore, we base this discussion on the development of a hypothesis regarding the impact of different institutional constraints on the marginal effects of

bribery on firms’ EI decision-making.

In this paper, we follow Halila (2007) in using data regarding organizational EIs based on ISO 14001² to develop a model that can be used as a guideline for the adoption of an Environmental Standard Certificate (ESC) for SMEs in Vietnam. There are good reasons to explain our decision to select this variable. As contended by Delmas (2000), the Environmental Management System (EMS) is a voluntary environmental approach that expects participants to commit themselves to reducing their adverse impact on the environment. The EMS includes a set of rules developed by the managers of an organization to help it achieve internally established environmental goals (Coglianese and Nash, 2002). Firms develop their own system in their efforts to comply with the standards of the EMS. Since ESC is the international standard for EMS (Szymanski and Tiwari, 2004), it is the voluntary decision of a firm to introduce EIs. In Vietnam, Decree no.80/2006/ND-CP (GOV, 2006) guides the implementation of several articles of the Law of Environmental Protection No.52/2005/QH11 (GOV, 2005), and firms are required to submit an environmental impact assessment (EIA) report to receive the ESC. To obtain an EIA, firms must successfully comply with the standards on various environmental issues, including air quality, water pollution, waste disposal, soil degradation, noise, and heat. Furthermore, the EMS system in Vietnam could be regarded as an environmental innovation as argued by OECD (2015) and Kemp and Arundel (1998). However, Williams and Dupuy (2017) indicate that the implementation of EIAs and whether the findings of EIAs are actually employed in decision-making processes determine the effectiveness of EIAs. While transparency and accountability are requirements to perform the functions of EIAs, there are challenges in implementing EIAs in countries where corruption is a common issue like Vietnam. Therefore, proposed projects experience a high risk of rejection and serious delay. Under this circumstance, firms may accept to pay bribes to reduce these risks.

We apply a probit regression employing SME survey data from 2011 to 2015 collected by the Central Institute for Economic Management (CIEM) to investigate the effects of bribery on EI, and our proposed hypotheses concern the mediating roles of a firm’s bargaining power and credit and institutional constraints. We use two variables for the two forms of bribery: the share of total annual revenue paid as informal payments to public officials to “get things done” with regard to customs, taxes, licenses and regulations (as greasing bribery); and the share of contract value as informal payments to public officials to secure government contracts (as rent-seeking bribery). In addition, we also create dummy variables to capture the extent of the bribery. We follow Decree 56/2009/ND-CP to define micro- and small-sized firms, using a dummy variable for each group. The group of credit-constrained firms is broken down into those that have demand for more loans (applied loans), those that are self-rationing (require loan), and those not seeking a loan application because of the cost (discouraged borrowers). We also consider different types of institutional constraints: self-evaluation of firms on government policy uncertainty and unfair competition. To conduct a robustness check on the effects of institutional constraints, we also employ another dataset, namely the provincial competitiveness index (PCI) to capture the current status and recent changes in the business environment in Vietnam across provinces and cities. The sub-indices of the PCI index are also employed for further analysis. As discussed in the literature, the bribery variable may be endogenous due to reverse causality between bribery and innovation, and this endogeneity

² Kemp and Arundel (1998) argue that environmental innovations consist of environmental training programs, green product design programs, the introduction of environmental learning techniques, the creation of management teams to address environmental problems, and environmental management and auditing systems such as the Environmental Management System (EMS) based on ISO 14001. EMS could be regarded as organizational environmental innovation (OECD, 2015).

may result in biased estimation results. Therefore, we use the instrumental variable (IV) method to mitigate this problem.

Our paper makes both theoretical and empirical contributions to the literature. Regarding theoretical contributions, we augment the literature by theorizing the mediating roles of firms' internal factors (bargaining power), institutional factors, and financial constraints on an association between corruption and environmental innovation. To attain this goal, we combine both institutional theory (DiMaggio and Powell, 1983) and resource-based theory (Cuerva et al., 2014; Galbreath, 2017) to explain the direct effects and the mediating roles of internal and institutional factors in this study. Regarding empirical contributions, our study is the first to provide clear empirical evidence of the association between bribery and EIs in Vietnam.³ This study is also the first to distinguish the effect of greasing bribes and rent-seeking bribes on environmental innovation implementation. Based on our theoretical framework, this paper is the first to investigate the association between bribery and EI decisions for firms with weak/strong bargaining powers and/or those that face credit constraints and institutional constraints. We contend that the effects of bribery on environmental innovation are conditional on firm-specific factors and their operating environment. The results of our benchmark model support the hypothesis that greasing bribery is known to grease the wheels of EI. The findings of our additional analysis also suggest that there does not exist the potential issue that EI is acquired through bribery without proper checks and compliances in our sample. The positive effects of greasing bribery are more sizable for larger-sized, formally registered firms or those facing credit constraints, while the magnitude of impacts from bribery for firms facing institutional constraints are also different depending on the specific types of constraints that firms perceive as the major growth obstacles. When breaking down the data into groups of different types of credit issues, they all reduce the effects that greasing bribery has on EI decisions. The effects of greasing bribery also become more sizable when we control for the endogeneity problem. Furthermore, we also find evidence to support the "sanding-the-wheels" hypothesis of rent-seeking bribery. We believe that untangling the relationship between bribery and environmental innovation has great implications for policymakers.

This study is about incentives. First, at the current stage of development, the Vietnamese government is not ready to issue a mandate for all businesses to meet high environmental requirements. In most cases, environmental innovation is voluntary on the part of firms. Government policies to promote environmental innovation are implemented mostly through manipulating the incentives of firms so that results of their cost-benefit analysis would favor undertaking innovation activities (Clancy and Moschini, 2018). To understand this decision-making process, policy makers must be aware of the factors that have a significant influence on the results. Formulating a policy without taking into account these factors might lead to inefficient outcomes or even unwanted side effects.

On the other hand, while corruption and bribery should not exist in an ideal business environment, in developing economies, including Vietnam, it has an undeniable presence and could have a significant influence on firms' decisions. Policymakers do acknowledge this situation when making laws and regulations. Therefore, the authors believe that studying the mechanism of the relationship between bribery and environmental innovation decisions in firms is important and would have strong policy implications. In the literature, prior scholars have not completely addressed the issue of how to promote EIs in developing countries like Vietnam where corruption has been acknowledged as an accepted norm (Nguyen et al., 2017; Ha et al., 2021b) and there has been a serious warning about an environmental degradation (Ha et al., 2021a, 2021b). Providing a clear conclusion on the relationship between

³ There has been no empirical study on the determinants of environmental innovation in Vietnam thus far since the data on this issue is confidential and accessible by permission.

bribery and environmental innovation in Vietnam not only makes an empirical contribution to the literature but also helps policymakers design relevant policies more precisely and effectively.

The remainder of the paper is structured as follows. Section 2 discusses related works and then develops the hypotheses. Section 3 describes the datasets employed in this study, then presents the development of a model at the firm level to assess the different factors affecting firms' ability to implement EI. Section 4 reports the empirical results and analyses the main findings. The conclusions and policy implications are provided in Section 5.

2. Theoretical Background and Hypothesis Development

In this article, we make theoretical contributions by combining both institutional theory (DiMaggio and Powell, 1983) and resource-based theory (Cuerva et al., 2014; Galbreath, 2017) to explain the direct effects as well as the mediating roles of internal and institutional factors. While resource-based theory concentrates on firms' internal capacities, the regulatory structures, government laws and regulations, courts, and professions are addressed in institutional theory (Oliver, 1991). In addition to using institutional theory and resource-based theory to investigate the driver of EIs as in prior studies, we theorize the mediating roles of firms' internal capacities and institutional factors such as political instability, unfair competition, and the quality of the investment environment on a relationship between bribery and environmental innovation performance.

2.1. Bribery and Environmental Innovation

2.1.1. Greasing Bribery and Environmental Innovation

Greasing bribery is referred to in the literature as the informal payments that firms pay to public officials to facilitate government-related activities. As argued by Nguyen et al. (2020a), greasing bribery is paid to help firms expedite administrative procedures, obtain permits and licenses, access legitimate services, or avoid harassment. Business time and the amount of paperwork can be reduced if firms pay this type of bribery. Greasing bribery does not directly prevent the competitors of bribing firms from accessing the procedures or services. Two main features of greasing bribery are: (i) the payers of greasing bribery are legally entitled; and (ii) they are more likely to know the amount of each transaction in advance and the transaction values are not significantly different among firms.

The literature develops the so-called "greasing-the-wheels of innovation" hypothesis. This paper develops the hypothesis that greasing bribes can positively affect firms' conventional innovation in general, and environmental innovation in particular. Prior scholars provide several arguments to support this hypothesis. First, greasing bribes may help firms deal with the uncertainty and risks resulting from the behaviors of the government, especially in emerging markets (Acemoglu and Verdier, 1998). Leff (1964) and Leys (1965) argue that ill-functioning institutions and poor governance structure may lead to distortions in the economy that can be effectively alleviated by bribery. Lui (1985) advocates this point when noting that bribes can reduce time cost, such as the time spent in a queue, in legally entitled firms. Moreover, bribes serve as incentives for officials to deal with firms' requests more quickly, therefore speeding up bureaucratic procedures, especially where the salaries of officials are low (Méon and Sekkat, 2005). Leys (1965) and Bailey (1966) contend that bribery can improve the quality of public servants. Krammer (2014) claims that bribes either grant firms access to decision-making processes that might give them approvals on new products or help them overcome bureaucratic inefficiencies and sub-par public services such as licenses and permits that are related to the introduction of innovations to the markets. Second, resources and licenses tend to be allocated to the most efficient firms since they can pay the largest bribes (Méon and Sekkat, 2005). Accordingly, innovation can be stimulated by the use of bribery. Following the concept and

features of greasing bribery, we believe that there is a positive association between greasing bribery and innovation.

Recent empirical evidence supporting the view of “greasing-the-wheels of innovation” exists at the firm level. The study of [Krammer \(2014\)](#) provides empirical evidence to advocate that bribing positively influences firms’ innovation performance. [Nguyen et al. \(2016\)](#) analyze the impacts of corruption on firm performance in Vietnam. Their empirical results support the greasing hypothesis of corruption on innovation. However, there is no paper investigating the impacts of greasing bribery on environmental innovation. Therefore, in this paper, we concentrate on the relationship between greasing bribery and environmental innovation.

In this article, we propose that there is also a positive association between greasing bribery and EIs. The reasons are as follows. First, firms are required to submit an EIA report to apply for the ESC. According to [Williams and Dupuy \(2017\)](#), the EIA, which is a foundational part of the environmental decision-making process, plays a vital role in identifying and potentially mitigating the environmental and social consequences of proposed projects ([Ebisemiju, 1993](#)). Yet, the effectiveness of EIAs is conditional on how EIAs are implemented and whether their findings actually influence firms’ decision-making processes ([Williams and Dupuy, 2017](#)). Theoretically, EIAs need to be transparent, accountable, and participatory. However, prior studies such as [Paliwal \(2006\)](#), [Transparency International \(2011\)](#), and [Dougherty \(2015\)](#), provide empirical evidence to indicate that there are challenges posed by corruption in implementing EIAs. These difficulties stem from the monopoly and discretionary power exercised by bureaucrats in the process of EIAs, the uncertainty of EIA outcomes, and the conflicts of interest in EIA processes. Four steps involved in carrying out an EIA are: screening, scoping, report preparation, and report submission and review⁴; however, in theory, there is corruption risk across each of the stages ([Williams and Dupuy, 2017](#)). In particular, corruption risks stemming from conflicts of interest between the public and private sectors in carrying out EIAs cause EIAs to be financially costly and time-consuming, thus increasing the overall costs of the proposed project, which in turn may lead to higher risk of rejection or severe delay. Under this circumstance, bribery can be employed to reduce these risks.

Second, there are differences between conventional innovation and environmental innovation in the sense that the latter produces a double positive externality, including both the usual knowledge externalities in the research and innovation phase and the environmental externalities in the adoption and diffusion phases ([Rennings, 2000](#); [Oltra, 2008](#)). As a result, there is a lack of private incentives, which then leads to underinvestment in EIs⁵ compared to the socially efficient level ([Oltra, 2008](#)). Therefore, environmental policies and the appropriate framework should become the main driver of EIs. It is worth noting that environmental policy types do matter ([Porter and van der Linde, 1995](#)). As revealed by [Popp \(2009\)](#), incentives for innovation are created by market-based policies since they provide rewards for firms that have continuous improvements in environmental quality, while command-and-control policies sanction polluters who do not comply with the standards. The subsidies; including low-interest loans, grants, favorable tax treatment, and preferential procurement policies, may help firms overcome financial barriers, which [Reid and Miedzinski \(2008\)](#) consider as the most important factor. Therefore, these subsidies incentivize different actors to comply with environmental laws. Moreover, since EI

⁴ See [Glasson et al. \(2013\)](#) for the detailed descriptions of the four stages of an EIA process.

⁵ On the one side, the implementation of environmental innovations can enhance firms’ competitiveness and public image through an improvement of their comparative advantage, resource efficiency ([Rennings, 2000](#)), cost reduction ([Koilara, 2018](#)) and product quality ([Porter and van der Linde, 1995](#); [Fadly, 2020](#)). These benefits from environmental innovation promote the implementation of EIs, thus lead to overinvestment in EIs.

is a complex and expensive process ([Dermody and Hammer-Lloyd, 1996](#)), firms engage in bribery to get ahead with implementing their EIs. Hence, bribes can serve as a vital tool to promote EI implementation.

It is worth noting that there is a potential risk that the EIA may be acquired through bribery as a requisite – “a box-ticking exercise” – without proper checks or compliance.⁶ There are certain reasons for this belief. First, in the case that there is inadequate transparency in the EIA process, or the responsible public officials do not subject themselves to public scrutiny ([Horberry, 1984](#)), “undue influence can be exerted to receive a favorable EIA review, thus project approval” ([Williams and Dupuy, 2017](#)). The empirical evidence in China is provided by [Huang and Liu \(2014\)](#). Also, firms are motivated to pay bribes to evade environmental laws ([Teichmann et al., 2020](#)). Second, although environmental policies such as subsidies incentivize firms to comply with the EIA, bureaucrats could misallocate these subsidies in favor of firms that pay bribes ([Teichmann et al., 2020](#)).

To account for the existence of this problem in our sample, we conduct a robustness check where the proxy of environmental innovation used in this study is more carefully controlled. Environmental innovation is the dummy variable that takes the value of 1 if firms have a certificate for registration of satisfaction for environmental standards. For these certified firms, we only focus on those investing in equipment used to treat environmental issues.⁷ By adopting this approach, we believe that the certified firms implement environmental innovation, and in most cases, these are not firms that get EIA approval through paying bribes.

Based on our discussion, we propose the following hypothesis:

H1a. Greasing bribery of firms paid to public officials is positively associated with environmental innovation.

2.1.2. Rent-seeking Bribery and Environmental Innovation

Rent-seeking bribery, referred as “real bribery” by [Bailes \(2006\)](#), or “real corruption” or “grand corruption” by [Argandoña \(2005\)](#) and [Rose-Ackerman \(2006\)](#), is employed to gain an advantage over competitors ([Bliss and Tella, 1997](#); [Ades and Di Tella, 1999](#)). Rent-seeking bribery is enabled by the existence of barriers such as regulations or licensing procedures where public officials have the power to restrict entry ([Nguyen et al., 2020a](#)). Firms tend to pay this type of bribery to gain access to government contracts or resources, as argued by [Ades and Di Tella \(1999\)](#), and [Galang \(2012\)](#). Therefore, paying rent-seeking bribery can either naturally or artificially limit the number of competitors or allow firms to share rents with bureaucratic officials ([Ades and Di Tella, 1999](#); [Fisman and Golden, 2017](#)). Furthermore, competitive advantage in the domestic market for bribing firms is also enhanced due to illegal cost reductions from avoiding taxes and regulatory fines ([Alon and Hageman, 2013](#)) or investments in pollution control ([Hassaballa, 2015](#)).

Rent-seeking bribery has two main features. First, in contrast with greasing bribery, the payers of rent-seeking bribery may not be legally entitled ([Nguyen et al., 2020a](#)). This type of bribery can make the competition unfair and put other firms who do not pay, or pay less, at a disadvantage because of higher operational costs. Second, the payers do not know accurately the amount of the payment before the transaction. The rent size and number of participants in this competition determine the “price.” Rent-seeking bribery is therefore an uncertain game in which the players need to place a reasonable “bid” to win the game and secure limited opportunities.

In this paper, we believe that firms paying rent-seeking bribes are less likely to implement EI. Firms are uncertain in this “rent-seeking bribery” game as the possibility of being a winner is unknown ([Nguyen et al., 2020a](#)). Firms need to bid bribe amounts that are sufficiently large to increase their opportunity of winning. These costs are detrimental to

⁶ We greatly appreciate the Reviewer for pointing out this issue.

⁷ The detailed discussion is provided in the next section.

the financial performance of losing firms, while the gain of winning firms is sustainable only if the barriers to entry block new participants from entering the bribery contest (Fisman and Svensson, 2007). This higher level of uncertainty and transaction costs of rent-seeking bribery therefore make conventional innovative opportunity in general, and environmental innovation opportunity in particular, less attractive commercially (Luo, 2004). A lack of resources leads to adverse effects of bribery on innovative activities (Mahagaonkar, 2010). Following this line of discussion, we believe that rent-seeking bribery paid to public officials causes firms to invest less in EI.

Thus, we propose the following hypothesis:

H1b. Rent-seeking bribery of firms to public officials is negatively associated with environmental innovation.

2.2. Effects of Bribery on Environmental Innovation for Firms With Different Levels of Bargaining Power

Several prior works indicate that the effects of bribery are contingent on the bargaining power of firms vis-à-vis public officials (Bliss and Tella, 1997; Fisman and Svensson, 2007). In the same vein, this paper investigates the effects of firms' bargaining power on the relationship between bribery and environmental innovation. Rose-Ackerman (1978) states that firms' bargaining power determines their ability to refuse bribery or to negotiate for better net benefits. Furthermore, firms with stronger bargaining power also reduce the risk that government officials refuse to deliver the agreed services or request additional payments, stemming from the secrecy and illegality of the transactions (Lambsdorff and Teksoz, 2004).

Following previous studies, we also consider other factors, including firms' capacity, social-political legitimacy, and political connections, that contribute to the bargaining power of firms (Rose-Ackerman, 1978; Aldrich and Fiol, 1994; Galang, 2012). Furthermore, the bargaining power of firms is determined by the availability of alternatives to bribery. Firms with multiple locations or choices other than bribery may be able to refuse to pay bribes or negotiate for better net benefits (Lee et al., 2010). Based on the above discussion, we argue that firm size and legal status (formal or informal registration) contribute to their bargaining power vis-à-vis public officials, and thus they may grasp more benefits from their paid bribes.

2.2.1. Firm Size and Benefits of Bribes

Rose-Ackerman (1978) claims that large firms have opportunities to earn greater benefits from bribery activities than small firms. Previous works list several reasons to explain this argument. First, large firm size implies stronger financial and technical capacities, thus enabling these firms to create more jobs and contribute more taxes to the local government budget. Hence, the government tends to favor large-sized firms compared to small-sized firms. Second, Zhou and Peng (2012) argue that large firms have closer connections to local political agents, thus participating in closed political networks that allow them to avoid "extortion" bribes (De Jong et al., 2015) or to gain access to "lucrative business opportunities" (Nguyen et al., 2017). Third, large firms tend to be more diversified with alternatives to bribes since they have branches in separate locations. As a result, these firms have more opportunities to engage in benefit-seeking bribes to gain favor regarding regulations (Galang, 2012). This preferential treatment and lower transaction costs make innovative activities more attractive commercially (Luo, 2004). Therefore, large-sized bribing firms are more likely to implement EIs.

In contrast, Nguyen and Bryant (2004) contend that small-sized firms have limited resources and professional staff to deal with complex administrative procedures (Nguyen and Bryant, 2004). With weak bargaining power, they are often required to pay survival bribes or are subjected to stringent monitoring by local officials (Smallbone et al., 2014). Rent-seeking officials tend to put small and less efficient firms out of business, while surviving small firms have the chance to earn more

and then pay more in bribes (Bliss and Tella, 1997). As a consequence, the increased transaction costs disincentivize small enterprises from performing environmental innovation. Regarding EI, Chen (2008) indicates that this type of innovation requires considerable financial and human resources, and larger-sized firms appear to have greener core competence and innovation performance. Based on the aforementioned discussion, we raise the following hypothesis:

H2. The effect of bribery on environmental innovation is greater for larger-sized firms.

2.2.2. Firms' Legal Registration and Benefits of Bribes

In this part, we consider whether registering a business contributes to a firm's bargaining power vis-à-vis public officials. Unregistered firms tend to avoid taxes. They have limited opportunities to borrow from any formal financial resources, access government programs, or export their products (Rothenberf et al., 2016). For these firms, we believe they have low bargaining power. First, there is consensus that informal firms are often small- or micro-sized firms. Rothenberf et al. (2016) provide empirical evidence to support this argument by indicating that the informal firms in Indonesia mostly have less than five employees. As argued previously, small firms have low bargaining power and thus may grasp fewer benefits from their paid bribes. Therefore, they have a lower incentive to implement innovative activities. Moreover, small-sized firms also lack financial and technical capacities as well as access to formal financial resources to make innovation possible.

Second, informal firms cannot access foreign markets and thus have lower bargaining power vis-à-vis public officials, in bribery. Lee et al. (2010) provide empirical evidence to support this view. Furthermore, Trindade (2005) states that exporting is regarded as a tool for promoting productivity and improving technological innovation, especially by governments in developing countries. Moreover, there are more advanced business practices abroad for exporting firms to learn about. Krueger (2008) shows that exporting firms are required to comply with their foreign partners' codes of production, including anti-corruption practices. Participating in foreign markets thus improves these capacities to enhance firms' bargaining power. Another point raised by Nguyen et al. (2020b) is that exporting firms have alternatives to domestic markets, therefore they can redirect their businesses to foreign markets if there are high bribery costs within the domestic markets. Third, informal firms are usually involved in tax evasion, black market activities, and petty trading. This type of firm, therefore, has to pay additional informal fees to deal with customs and quality control. Based on our discussion, we believe that legal registration can amplify the effect that bribery has on innovation, and thus we propose the following hypothesis:

H3. The effect of bribery on environmental innovation is greater for formally registered firms.

2.3. Effects of Bribery on Environmental Innovation for Firms Being Credit-constrained

For an SME in a developing economy, access to external credit is an ongoing issue that always has a strong impact on many aspects of a firm's operation, including innovation activities. A survey of Vietnamese SMEs in the period from 2005 to 2015 finds that around 25% of the sample is credit-constrained in some way (CIEM, 2013). In this study, we examine the dynamics between bribery and environmental innovation for firms facing credit constraints.

In the literature, there is ample evidence that lists financial constraints as one of the major barriers to corporate environmental investment (Goetz, 2018). The literature explores the link between external credit access and innovation activities. While preferred, internal funding is often inadequate for the implementation of major innovation in SMEs (Hottenrott and Peters, 2012). However, securing bank loans for these types of projects proves to be a great obstacle. Innovation

projects often involve long-term investment and have a high level of complexity and uncertainty (Hottenrott and Peters, 2012), which discourages bank lending.

While securing financial resources is of vital importance for innovation, SMEs are in an inferior position compared to larger firms from the perspective of the banks (Berger and Udell, 2006). Lending money to SMEs is riskier and requires higher transaction costs for screening and monitoring. To overcome this situation, many firm owners resort to bribing the credit officials, which leads the SME credit market to become a fertile ground for corruption (Wellalage et al., 2019). So far, the relevant literature has not reached a consensus on the effect of bribing/paying informal costs to officials, or its use as a tool that SMEs in developing economies could utilize to deal with credit accessibility problems. Specifically, on this aspect, economists are still arguing over the role of bribery as “the grease” or “the sand” to “the wheel” when it comes to alleviating credit constraints.

In one strand of literature, some studies show evidence of bribery being beneficial to firms. Paying governmental or banking officials is widespread in some countries, and it could help increase the prospect of loan applications being accepted, speeding up the process of bureaucratic procedures, and avoiding being stuck in complex and unclear regulations (Wellalage et al., 2019). Firms with political connections receive substantial preferential treatment from credit institutions (Khawaja and Mian, 2005). Evidence from transition economies, including firms from Russia and China, shows that when borrowers take the initiative by bribing credit officials, their chances of getting access to external credit are significantly improved (Chen et al., 2013; Weill, 2011). Tran and To (2018) show evidence from Vietnamese firms that the probability of getting official loans accepted is increased when firms pay for bribes and gifts.

On the other hand, corruption, and specifically the practice of bribery, could also result in greater difficulties for firms in getting access to credit. The pervasion of corruption can create a disturbance in the market for loanable funds. From the view of the banks, screening and selecting loan applications in the face of corruption is riskier (Wellalage et al., 2019). When there are defaults or other disputes between borrowers and lenders, engaging in bribery would prevent banks from using court enforcement to settle the issues (Porta et al., 1998). This situation creates a disincentive for banks to lend, which reduces the supply of bank loans and increases constraints on businesses. From the perspective of firms, especially SMEs with limited resources, bribing acts as a form of tax on lending that increases the effective cost of the loan, which discourages certain firms from applying for credit (Weill, 2011). In a survey of firms from five South Asian countries, Wellalage et al. (2019) finds that bribery increases the probability of SMEs experiencing credit constraints.

In this study, we argue that the inconclusiveness in the literature regarding the effect of bribery on credit accessibility results from issues with identification and measurement. Therefore, we propose several variables to distinguish between the different forms of bribes and credit constraint, as well as their dynamics. On the one hand, we have different variables for “greasing bribe” and “rent-seeking bribe” as defined in the previous sections. We hypothesize that the negative effects on credit conditions result from the prevalence of rent-seeking bribes and they can only be explored on a macro level. Greasing bribes, on the other hand, help firms secure loans from external institutions and obtain the necessary funding to pursue environmental innovation projects. Additionally, we also break down the group of firms with credit issues into those who have demand for more loans (either by applying for loans or by explicitly saying that they need a loan), and those who are discouraged borrowers who gave up on accessing external credit due to the too-high cost, following the model of Casey and O’Toole (2014).

Based on these discussions, we propose that the state of being financially constrained has a mediating role in the relationship between using greasing bribes and environmental innovation. Other things remain the same. Bribing firms with no urgent financial constraints are

more likely to convert their advantages into environmental innovation, while bribing firms with financial constraints are less likely to do the same. Therefore, our hypothesis is stated as follows:

H4. Being credit-constrained (both from the demand side and supply side) reduces the effect of greasing bribery on the probability of environmental innovation decisions.

2.4. Effects of Bribery on Environmental Innovation for Firms Being Institutionally Constrained

Prior scholars highlight the importance of institution quality on economic development. In particular, North (1990) and Rodríguez-Pose (2013) indicate that good institutional quality determines the path of long-term economic development. Institutional arrangements are those factors that impede the development of a region, by causing inefficiencies and interfering with other challenges of economic development (Rodríguez-Pose, 2013).

Regarding innovative activities, many scholars advocate the view that bureaucratic inefficiencies hinder innovation. First, innovation can be considered as a long-term process that may encounter multiple obstacles from government bureaucrats, especially in areas with weak and poor institutions. Firms that wish to innovate need to obtain licenses from these officials. Blackburn and Forgues-Puccio (2009) contend that public officials behave as individual monopolists and choose the levels of bribes that maximize their benefits. Moreover, Acemoglu and Verdier (1998) reveal that given the higher regime change frequency and the legislation’s incoherence in emerging countries, the behavior of the government becomes a major risk to investors. In the same line of discussion, corrupt officials in areas with weak and poor institutions tend to protect their illegal income by creating distortions in the markets, reducing the motivation for firms to carry out innovation (Kurer, 1993). Second, greedy and corrupt officials in weak and poor institutions cause innovative firms to face a wider variety as well as a higher number of bribes (Fisman and Svensson, 2007). In these circumstances, firms have fewer resources to implement innovation. Third, weak and poor institutions may lead to a reduction in both domestic and foreign investments as well as inefficient allocations of public resources, which are more vulnerable to bribery-related manipulations (Bassetti et al., 2015). Since foreign investment is known to be a vital source of technology transfer for the host country, innovative activities tend to decrease in areas with weak and poor institutions. Based on our discussion, we propose the following hypothesis:

H5a. Being institutionally constrained reduces the effect of bribery on the probability of environmental innovation decisions.

Another line of thought is that weak institutional environments create pressure on firms to bribe public officials. In such an environment, bribery is regarded as a socially acceptable pathway to success (Ufere et al., 2012). In other words, bribes are employed to reduce uncertainty and informational asymmetries pertaining to innovation implementations. The innovative activities can be facilitated faster for bribing firms (Krammer, 2014). This gives rise to the following hypothesis:

H5b. Being institutionally constrained amplifies the effect of bribery on the probability of environmental innovation decisions.

Our theoretical framework is summarized in Fig. 1.

3. Model Specification

The model is specified as follows:

$$EI_i = \beta_0 + \beta_1 \text{Bribery}_i + \beta_2 \text{Control}_i + \varepsilon_i, \quad (1)$$

where subscript i denotes the firm i . Environmental innovation EI_i is the dummy variable that takes the value of 1 if firms have a certificate for

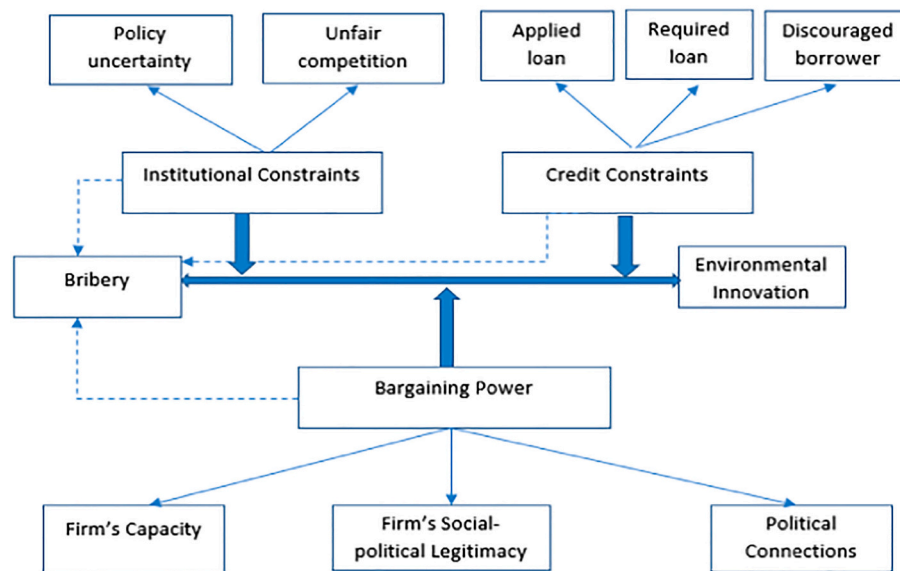


Fig. 1. Theoretical framework.
Source: Authors' development.

registration of satisfaction for environmental standards. These certified firms perform activities to treat environmental factors.⁸ As argued previously, there may be the potential risk that EI can be acquired through bribery instead of compliance with international standards. To conduct further checks on the existence of this issue in our sample, we control this variable by only considering the certified firms that are investing in equipment used to treat environmental issues, including air quality, fire, heat, lighting, noise, waste disposal, water pollution, soil degradation, and others.⁹ $Bribery_i = \{DRBri_i, lnRBri_i, DGBri_i, lnGBri_i\}$ is a set of bribery variables¹⁰ in which $DRBri$ and $DGBri$ are, respectively, the dummy variables that take a value of 1 if a firm pays rent-seeking or greasing

⁸ We controlled this by selecting firms that answered “Yes” to the question “Do firms treat the environmental factors?” during the survey.

⁹ In the survey, firms were asked: “Which of the following environmental factors does your firm treat and how much do they cost?” after providing the answer to the question: “Does the firm have a ‘Certificate for registration of satisfaction of environmental standards’ (ESC)?” Environmental innovation (EI) takes the value of 1 if firms possess the environmental standard certification and make investment in equipment used to treat the environmental issues, including air quality, fire, heat, lighting, noise, waste disposal, water pollution, soil degradation and others.

¹⁰ The limitation of our database does not permit us to check the situation that firms use both “rent-seeking” and “greasing bribery”. In the survey, the respondents were asked: “Do you have to pay informal/communication fees” and if they said “yes,” the following question was “What is the bribe payment/communication fee mainly used for?” and the respondents selected one of six options as follows: to get connected to public services (1); to get licenses and permits (2); to deal with taxes and tax collection (3); to gain government contracts/public procurement (4); to deal with customs/imports/exports (5); and other (6). We acknowledge this as a limitation of our study.

bribes. $lnRBri_i$ represents the natural logarithm of the share of total annual sales paid as informal payments to public officials, and $lnGBri_i$ the share of contract value as informal payments to public officials to secure government contracts. $Control_i$ is the set of control variables that include the log of real physical capital assets, $lnCap_i$; the log of number of skilled workers (workers with professional training at university or college level), $lnSkill_i$; the educational level of the owner, $educ_i$; the dummy for export participation, $expt_i$; firm size, $lnFirm_i$; firm profit, $profit_i$; and institutional quality, $ins_quality$. More details on the description and measurement of these variables can be found in Appendix A. Regarding institutional quality, we use the PCI,¹¹ which is designed to assess the ease of doing business, economic governance, and the efforts of administrative reform by local authorities in 63 provinces and cities of Vietnam (Malesky and Pham, 2020).

First, the relationship between bribery and environmental innovation decisions is investigated. Since we propose that this association might be contingent upon the firm’s bargaining power, we re-estimate Eq. (1) in different sub-samples based on firm size and legal registration status. Furthermore, as we also argue that credit and institutional constraints lead to change in this relationship, we compare the impacts of bribery on the probability of EI implementation for the sub-sample of firms encountering credit constraints with those facing no constraints. For further analysis of the mediating roles of credit constraints, we also break the firms down into those who wish to take out more loans, and those who are self-rationing and not looking for loan applications due to the high costs. Regarding institutional constraints, we regress Eq. (1) with the sub-samples for each type of constraint, based on firms’ self-evaluation of government policy uncertainty and unfair competition level. The interactions between each type of constraint and firm size are

¹¹ According to Malesky and Pham (2020), the overall PCI index score comprises ten subindices and a province that is considered as performing well on the PCI if it has: “1) low entry costs for business start-ups; 2) easy access to land and security of business premises; 3) a transparent business environment and equitable business information; 4) minimal informal charges; 5) limited time requirements for bureaucratic procedures and inspections; 6) minimal crowding out of private activity from policy biases toward state, foreign, or connected firms; 7) proactive and creative provincial leadership in solving problems for enterprises; 8) developed and high-quality business support services; 9) sound labor training policies; and 10) fair and effective legal procedures for dispute resolution and maintaining law and order.”

also examined. We also investigate the effect of bribery on EI decisions across sectors.

In our study, we show that there is a simultaneity between bribery and EI decisions, which might cause our regression results to be biased. There are plausible reasons to explain why bribery and EI are potentially endogenous. First, public officials use firm performance to assess the ability of a firm to pay (Fisman and Svensson, 2007). The firm’s performance is, in turn, reflected by the firm’s capacity to implement innovation (Nguyen et al., 2016). Regarding EI, prior works also indicate a relationship between this type of innovation and firm performance (Cainelli et al., 2011); hence, more innovative firms are more likely to pay bribes. Second, EI is a complicated and expensive process (Dermody and Hammer-Lloyd, 1996). In the context of poor and weak institutions and highly inefficient and bureaucratic systems, long administration delays and slow-moving queues for public services are common. Faced with that situation, firms are willing to pay bribes to acquire a license to develop a novel product or process, especially if it contributes to reducing environmental risks, pollution, and other detrimental effects of resource use. Therefore, there might be a potential reverse causality between corruption and the implementation of EI. Third, the literature reveals that there are unobserved influencers of firms’ innovation capacity and bribery that cause an estimation of $Bribery_i$ to be biased (Nguyen et al., 2017).

Following Fisman and Svensson (2007), and Nguyen et al. (2017), the sector-location average approach is employed to deal with the issue of endogeneity bias. According to Qui and Ongena (2018), firms’ bribery amounts average across firms within the same locality and sector excluding the firm itself. As a result, the sector-location average of the bribery payment amount, which is exogenous to the firm, is specified by the production characteristics of the sector and the rent-seeking ability of the bureaucrats. The sector-location average approach can minimize omitted unobservable errors related to bribe intensity at the firm level. Furthermore, firms’ attitude toward the level of system corruption, proxied by the trend of bribe amounts is employed as another instrument. Like Nguyen et al. (2020a), who use firms’ perceptions of corruption prevalence in the country and the sector as instruments for bribery, we choose our instrument variable to be the firms’ prediction of changes in the level of system corruption (proxied by the bribe payment amounts). Firms predicting an increase in bribe payments are asked to provide reasons to explain their belief that are either due to “difficulties to comply with the government regulation” (*gov_reg*) or “introduction of new product and process” (*newpro_dif*).

Specifically, the bribery faced by a typical firm operating in the i -th industry at the j -th location (Bri_{ij}) consists of two components:

$$Bri_{ij} = bri_{ij} + bri_j$$

where bri_{ij} refers to an idiosyncratic element and bri_j is the average amount of bribe that is common to all firms in the i -th industry at the j -th location. The underlying assumption is that there is no association between sector-province average bribing rates and a firm’s innovative performance. The present study uses sector-province average as our instrument in the case of Vietnam’s enterprises. Using the instrumental variable method, our model becomes:

$$EI_i = \beta_0 + \beta_1 Bri_i^V + \beta_2 Control_i + \varepsilon_i$$

where Bri_i^V is the fitted value from the first-stage regression where rent-seeking and greasing bribery are regressed on location-province bribe average and other control variables.

4. Data Description

This paper uses survey data on small and medium-sized enterprises (SMEs) in Vietnam, conducted by CIEM from 2011 to 2015. The Vietnam SME Survey addresses the fact that a large part of Vietnam’s economy is unregistered or newly registered household establishments that are not

captured well in the official statistics. The survey is planned and carried out in collaboration between the CIEM of the Ministry of Planning and Investment (MPI), the Institute of Labor Science and Social Affairs (ILSSA) of the Ministry of Labor, Invalids and Social Affairs (MOLISA), the Development Economics Research Group (DERG) of the University of Copenhagen and UNU-WIDER. The original purpose is to conduct a representative survey of non-state manufacturing enterprises which include establishments in both the formal and informal sectors of the economy. The sample is selected based on this objective (Berkel et al., 2020).

The firms in the sample come from ten provinces. These ten provinces jointly account for around 30% of the non-state manufacturing enterprises in Vietnam. In each province, a two-step sampling method is employed to first select districts within each province using proportion to size sampling, and then select firms within each district from the list of formal/registered non-state and household manufacturing firms (which included 164,468 firms in 2005). Information on informal manufacturing firms is collected using a snowballing technique. In each district, the surveyors select firms that are not on the “formal” list but are visually present for interview (on-site identification). Additionally, the enumerators are also asked to find as many additional informal firms as possible within each chosen site (block enumeration).

Another objective of the survey is to follow the same enterprise over time to get insight into its long-term development. The survey is therefore created as a tracer survey. The team re-interviews surviving firms in later rounds of the survey. Exit firms are replaced using two criteria: (1) holding constant the level of household enterprises from the 2002 Establishment Census; and (2) the updated population of registered firms from the annual GSO Enterprise Census data.

Regarding the concern over the validity of the data on bribery activities collected in the survey, we believe the results of the survey accurately reflects the situation in Vietnam for the following reasons:

- (1) The questions regarding bribery in the survey are only general questions on using informal/communication costs. The representatives of the firms do not have to disclose any sensitive information.
- (2) The interviewers are not accompanied by any representatives from the government and the information is kept confidential. The same procedures are also used in other surveys regarding bribery and corruption including the PCI survey or the World Bank SME survey.
- (3) Small bribery or facilitating fees are pervasive and considered the norm in Vietnam. Anti-corruption efforts in Vietnam are mostly focused on high-ranking government officials in elaborate corruption cases. There are also no known precedents of firms being prosecuted or discriminated against.

The data on institutional quality are taken from the PCI survey.¹² Table 1 shows the differences in bribing behaviors between environmental innovators and non-environmental innovators. It can be

Table 1
Comparisons of environmental innovators vs. non-environmental innovators.

Variable	Non-EI	EI
Rent-seeking bribe	0.04	0.05
Rent-seeking bribe amount	479.00	1500.62
Greasing bribe	0.34	0.57
Greasing bribe amount	1808.92	13,554.77

Source: Authors’ calculation.

¹² The data is available from the website: <https://pcivietnam.vn>.

observed that, on average, firms with environmental innovation are more likely to use bribes, in both categories. Environmental innovators had a 5% chance of paying a rent-seeking bribe compared to 4% in non-environmental innovators. The respective figures for greasing bribes are 57% and 34%. Regarding bribing amount, EI firms also spend a larger fraction of their total revenue on rent-seeking or greasing bribes. One point to note is that in both sub-samples, greasing bribes are much more prevalent and account for a much greater proportion of firms' cost structure than rent-seeking bribes.

In Table 2, the data is broken down into different groups to examine the relationship between bribery and environmental innovation for firms possessing different levels of bargaining power or facing financial constraints and institutional constraints. In Panel A, the bargaining power of the firm is proxied by firm size and the firm's legal status. In both cases, firms with greater bargaining power have a higher probability of implementing environmental innovation. Also, within the group of firms with comparable bargaining power, environmental innovators were more likely to bribe. For example, 35.4% of small firms are environmental innovators compared to 7.14% of micro firms. Within the group of micro firms, 55.74% of environmental innovators paid bribes compared to 41.48% of non-environmental innovators.

In Panel B, firms are divided by their status on several credit issues. As can be observed, credit-constrained firms are less likely to use bribes and are also less likely to become environmental innovators. Similarly, the group of firms that are discouraged borrowers (who do not want to apply for a loan due to complicated procedures or high costs) also have a lower probability of using bribes and of being environmental innovators. These firms have a lower probability of using bribes (43.62% compared to 45.45% of the total sample) as well as a lower probability of being environmental innovators (10.58% compared to 15.38% of the total sample).

For the sub-sample categorized by institutional constraints shown in Panel C, policy uncertainty seems to increase with the proportion of environmental innovators (22.96% compared to 15.24%) while the

Table 2
Percentages of environmental innovators and bribery firms (%).

Panel A: Bargaining power						
EI & Bribery	Micro			Small		
	Micro	Small	Total	Formal	Informal	Total
EI only	3.16	16.16	6.95	8.50	1.62	6.95
EI and bribery	3.98	19.24	8.43	10.73	0.52	8.43
Bribery only	38.52	33.39	37.02	35.75	41.40	37.02
No EI & no bribery	54.34	31.21	47.60	45.02	56.47	47.60
Total	100	100	100	100	100	100

Panel B: Credit constraints (%)						
EI & Bribery	Credit constraint ^a			Discouraged borrowers		
	No	Yes	Total	No	Yes	Total
EI and bribery	13.49	6.70	10.20	10.81	5.59	8.43
Bribery only	36.07	29.52	32.89	36.19	38.03	37.02
No EI & no bribery	46.70	60.83	53.55	44.42	51.38	47.60
Total	100	100	100	100	100	100

Panel C: Institutional constraints (%)						
EI & Bribery	Policy uncertainty			Unfair competition		
	No	Yes	Total	No	Yes	Total
EI and bribery	8.37	11.85	8.43	8.35	8.73	8.43
Bribery only	37.05	35.56	37.02	36.71	38.19	37.02
No EI & no bribery	47.71	41.48	47.60	47.68	47.29	47.60
Total	100	100	100	100	100	100

^a The data on being credit constrained is only available for 2648 observations (34% of the total sample).
Source: Authors' calculation.

proportion of bribing firms remains relatively unchanged (47.41% compared to 45.42%). There is also no clear difference in the chance of bribing and being an environmental innovator within the group with or without the perception of unfair competition.

The models in this study also include several control variables that are known to have an impact on bribing and investing in environmental innovation: capital intensity (*lnicap*); firm size, as measured by the number of full-time employees, (*lnfirm*); educational level of the owner (*educ*); the number of skilled laborers dedicated to innovative activities (*labskill*); the firm's engagement in internalization through exporting activities (*expt*); firm profit, (*profit*); and institutional quality, (*ins_quality*). The summary statistics for the whole sample, as well as for the sub-sample of environmental innovators and non-environmental innovators, are shown in Table 3.

Table 4 displays the correlation matrix between the key variables in this study. The correlation coefficients between the independent variables and control variables are significantly lower than 0.8. Also, the higher correlation coefficients in the matrix belong to those between the dummy variables, which are that firms pay bribes, and the share of total revenue spent on bribes. These variables are added one by one into separate regressions, therefore, there should be no problem of multicollinearity in our regressions.

5. Empirical Results

5.1. Main Results

We report the results of the benchmark model in Table 5. Columns 1–12 in Panel A show the effects of different forms of bribery on firms' environmental innovation decisions. In this analysis, we use both the dummy variables, which take the value of 1 if firms pay either rent-seeking (*DRBri*) or greasing (*DGBri*) bribes and the amount paid as rent-seeking (*lnRBri*) and greasing bribery (*lnGBri*) as a share of revenue. Our results support the hypotheses H1a and H1b. On the one hand, rent-seeking bribery decreases the probability of EI implementation by 0.15% but is statistically insignificant. On the other hand, the EI probability increases by 0.16% if firms decide to use greasing bribery to get things done concerning licenses, taxes, regulations, or services. The results in column 10 relate to greasing bribes as a share of firms' revenue and demonstrate a similar conclusion. The statistically positive signs of *GDBri* and *DBri* support our proposed hypothesis that greasing bribery paid to public officials serves as the oil that "greases-the-wheels" of innovation, an idea pioneered by Leff (1964) and Leys (1965). For a specific type of innovation like EI, this hypothesis still holds. We in turn control for the time effect, cross-section effect, and both effects simultaneously, but there is no significant difference in our estimations. Regarding the potential issue that firms may get approval by paying bribes but do not comply with the international standards, we conduct a robustness check by comparing the estimation results for the sample of certified firms with investment in equipment used to deal with environmental issues,¹³ to control for this issue. The results are outlined in Panel B of Table 5. In general, our conclusions still stand. This result can be explained by the fact that there is no significant difference between the two groups. The proportion of certified firms with activities and investment in equipment to deal with environmental problems are 88.22% and 84.63%, respectively, and the slight difference stems from missing observations because some firms did not respond to the question "Which of the following environmental factors does your firm treat and how much do they cost?" This analysis suggests that the aforementioned issue does not exist in our sample.

¹³ As argued previously in Section 3, we already control this potential issue by controlling certified firms that perform all activities to treat the environmental issues. To further check, we concentrate on certified firms that invest in equipment used to deal with the environmental issues.

Table 3
Control variables.

	All sample			EI = 0			EI = 1		
	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev
lncap	7688	7.72	1.56	6506	7.43	1.46	1182	8.70	1.48
lnfirm	7688	2.41	1.04	6506	2.20	0.93	1182	3.15	1.07
edu	7688	4.73	0.56	6506	4.69	0.59	1182	4.88	0.42
labskill	7688	0.05	0.08	6506	0.04	0.08	1182	0.08	0.08
expt	7688	0.10	0.31	6506	0.07	0.26	1182	0.21	0.41
profit	7688	5.24	34.53	6506	3.25	22.27	1182	16.45	70.48
ins_quality	7688	57.72	3.24	6506	57.6	3.19	1182	58.37	3.37

Source: Authors' calculation.

Table 4
Correlation matrix.

	DBri	Bri	DRBri	lnRBri	DGBri	lnGBri	lncap	lnfirm	edu	labskill	expt	profit	ins_quality
DBri	1												
Bri	0.054	1											
DRBri	-0.036	0.148	1										
lnRBri	0.010	0.480	0.616	1									
DGBri	0.036	-0.148	-0.160	-0.616	1								
lnGBri	0.049	0.770	-0.259	-0.160	0.259	1							
lncap	0.017	-0.142	0.035	-0.017	-0.035	-0.179	1						
lnfirm	0.014	-0.221	0.036	-0.042	-0.036	-0.256	0.642	1					
edu	-0.017	-0.029	0.041	-0.007	-0.041	-0.040	0.257	0.298	1				
labskill	-0.021	-0.076	0.042	-0.008	-0.042	-0.094	0.360	0.383	0.254	1			
expt	0.012	-0.055	-0.012	-0.015	0.012	-0.059	0.264	0.399	0.128	0.137	1		
profit	-0.010	-0.084	0.042	-0.025	-0.042	-0.097	0.220	0.275	0.075	0.101	0.191	1	
ins_quality	0.343	0.070	0.011	0.036	-0.011	0.056	0.167	0.074	0.017	0.002	0.077	0.088	1

Source: Authors' calculation.

We turn to analyze the effects of the control variables on EI decisions. Capital intensity (*lncap*); firm size, as measured by the number of full-time employees (*lnfirm*); the number of skilled laborers dedicated to innovative activities (*labskill*); and firms engaging in internalization through exporting activities (*expt*), are positive and statistically significant in our theoretical model. These findings are aligned with previous works in the literature on general innovation. Among these variables, *labskill* has the strongest effect on EI decisions. This finding implies that skilled laborers play a decisive role in EI implementation in Vietnamese firms. Our results regarding the role of human capital are consistent with [Cuerva et al. \(2014\)](#). [Hemmelskamp \(1999\)](#) highlights the dominance of incremental technologies in environmental innovation, and [Cuerva et al. \(2014\)](#) note that highly qualified staff are associated with more radical innovations. Moreover, our results display that firms' profit (*profit*), and quality of institution (*ins_quality*), positively affect the probability of EI implementation in our sample. Our findings imply that ease of doing business, economic governance, and administrative reform efforts by local governments in Vietnam play a decisive role in promoting the implementation of environmental innovation.

In the following analysis, we investigate the mediating roles of firm size, profit status, legal registration, credit constraints, and institutional constraints on the association between greasing bribery and EI decisions. The estimation results are outlined in Appendix B.¹⁴ We concentrate on greasing bribery for the following reasons. First, making bribes to get things done regarding licenses, taxes, regulations or services directly affects the decisions made in firms about EI implementation. Innovation is a long-term process that involves multiple actions from public officials, such as approvals, permits or licenses ([Krammer, 2014](#)). Greasing bribery grants firms access to the decision-making process related to new products and processes and provides a way of

¹⁴ We perform similar analysis for the sample of certified firms that invest in equipment to treat environmental issues. All conclusions still stand corrected. The results can be provided upon request.

dealing with bureaucratic obstacles and sub-par public services. For EI, the barriers and difficulties created by public officials become more prevalent. Second, the effects of rent-seeking bribery in the regression of sub-sample by size are insignificant.¹⁵

[Table B.1](#) in Appendix B reports the effects of firm size on the relationship between greasing bribery and EI decisions, by regressing the data in the sub-sample categorized by size with a focus on micro and small firms.¹⁶ A firm is defined as micro-sized if it has fewer than ten employees, while a small-sized firm has from 10 to 200 workers, according to the definition of SMEs specified in Decree 56/2009/ND-CP. Columns 1–4 of [Table 6](#) present our estimation results. The effects of greasing bribery on EI decisions differ according to firm size. Paying greasing bribery raises EI probability only in micro-sized firms. EI probability increases by 0.22% if micro-sized firms decide to pay greasing bribes. On the other hand, the higher percentage of total annual revenue paid as informal payments by micro- and small-sized firms raises EI probability. These effects become more prominent for small-sized firms. These empirical results support hypothesis H2 that the preferential treatment and lower cost advantages obtained from bribes are more pronounced in larger firms, which makes innovative activities more attractive commercially.

Subsequently, we control for firm profit to examine the association between EI and greasing bribery. We divide our sample into two sub-samples, including firms earning profits (*Profit*) and experiencing losses (*Loss*) in the market. In our sample, the "Profit" group makes up 98.84% of total firms. We then regress the data in each sub-sample by profit status and report the findings in [Table B.2](#) in Appendix B. The effects of greasing bribery on EI decisions differ according to firms' profit status. Paying greasing bribery raises EI probability only in profit-earning firms.

¹⁵ The results are available upon request.

¹⁶ Almost all firms in our sample are micro- and small-sized firms based on the definition specified in Decree 56/2009/ND-CP.

Table 5
Benchmark estimation results.

Panel A: For certified firms with activities to treat environmental issues												
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI
	Rent-seeking bribery						Greasing bribery					
DRBri	-0.15 (0.091)	-0.12 (0.095)	-0.11 (0.096)									
lnRBri				-0.33 (0.242)	-0.21 (0.225)	-0.21 (0.224)						
DGBri							0.16*** (0.042)	0.17*** (0.043)	0.18*** (0.043)			
lnGBri										0.40*** (0.109)	0.40*** (0.114)	0.43*** (0.114)
Incap	0.17*** (0.018)	0.17*** (0.018)	0.17*** (0.018)	0.17*** (0.018)	0.17*** (0.018)	0.17*** (0.018)	0.17*** (0.018)	0.17*** (0.018)	0.16*** (0.018)	0.17*** (0.018)	0.17*** (0.018)	0.17*** (0.018)
lnfirm	0.36*** (0.027)	0.41*** (0.030)	0.42*** (0.030)	0.36*** (0.027)	0.41*** (0.030)	0.42*** (0.030)	0.35*** (0.028)	0.40*** (0.030)	0.40*** (0.030)	0.37*** (0.028)	0.42*** (0.030)	0.43*** (0.030)
edu	0.03 (0.038)	0.07* (0.040)	0.09** (0.040)	0.03 (0.038)	0.07* (0.040)	0.09** (0.040)	0.02 (0.038)	0.06 (0.040)	0.08** (0.040)	0.02 (0.039)	0.06 (0.040)	0.08** (0.040)
labskill	1.26*** (0.299)	1.34*** (0.324)	1.23*** (0.326)	1.26*** (0.299)	1.33*** (0.324)	1.23*** (0.326)	1.17*** (0.300)	1.26*** (0.325)	1.14*** (0.327)	1.18*** (0.300)	1.27*** (0.326)	1.16*** (0.328)
expt	0.10 (0.071)	0.22*** (0.077)	0.23*** (0.078)	0.11 (0.071)	0.22*** (0.077)	0.23*** (0.078)	0.10 (0.071)	0.21*** (0.077)	0.22*** (0.078)	0.11 (0.071)	0.22*** (0.077)	0.23*** (0.078)
profit	0.01*** (0.002)	0.00 (0.002)	0.00 (0.002)	0.01*** (0.002)	0.00 (0.002)	0.00 (0.002)	0.01*** (0.002)	0.00 (0.002)	0.00 (0.002)	0.01*** (0.002)	0.00 (0.002)	0.00* (0.002)
inst_quality	0.04*** (0.007)	0.02** (0.007)	0.03*** (0.008)	0.04*** (0.007)	0.02** (0.007)	0.03*** (0.008)	0.04*** (0.007)	0.02** (0.007)	0.03*** (0.008)	0.04*** (0.007)	0.01** (0.007)	0.03*** (0.008)
Constant	-5.67*** (0.477)	-5.22*** (0.681)	-6.38*** (0.735)	-5.66*** (0.477)	-5.20*** (0.681)	-6.36*** (0.736)	-5.68*** (0.477)	-5.13*** (0.670)	-6.38*** (0.724)	-5.53*** (0.479)	-5.13*** (0.660)	-6.30*** (0.715)
Observations	7373	7371	7371	7372	7370	7370	7373	7371	7371	7350	7349	7349
Time effect	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES
Sector Effect	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Pseudo R2	0.203	0.252	0.256	0.203	0.252	0.256	0.205	0.254	0.258	0.204	0.254	0.258

Panel B: For certified firms with an investment in equipment used to treat environmental issues												
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI
	Rent-seeking bribery						Greasing bribery					
DRBri	-0.05 (0.093)	-0.01 (0.097)	-0.01 (0.097)									
lnRBri				-0.10 (0.231)	-0.00 (0.218)	0.00 (0.219)						
DGBri							0.15*** (0.046)	0.15*** (0.047)	0.16*** (0.047)			
lnGBri										0.48*** (0.116)	0.46*** (0.121)	0.49*** (0.120)
Incap	0.18*** (0.021)	0.18*** (0.020)	0.18*** (0.020)	0.18*** (0.021)	0.18*** (0.020)	0.18*** (0.020)	0.18*** (0.021)	0.18*** (0.020)	0.17*** (0.021)	0.18*** (0.021)	0.18*** (0.020)	0.18*** (0.021)
lnfirm	0.36*** (0.029)	0.40*** (0.031)	0.40*** (0.031)	0.36*** (0.029)	0.40*** (0.031)	0.40*** (0.031)	0.35*** (0.030)	0.38*** (0.031)	0.39*** (0.031)	0.37*** (0.030)	0.40*** (0.031)	0.41*** (0.031)
edu	0.09** (0.045)	0.13*** (0.046)	0.13*** (0.046)	0.09* (0.045)	0.13*** (0.046)	0.13*** (0.046)	0.08* (0.045)	0.12*** (0.046)	0.13*** (0.047)	0.08* (0.045)	0.12** (0.046)	0.12*** (0.047)
labskill	1.58*** (0.315)	1.54*** (0.338)	1.47*** (0.340)	1.59*** (0.315)	1.55*** (0.338)	1.48*** (0.340)	1.51*** (0.317)	1.49*** (0.340)	1.41*** (0.342)	1.52*** (0.316)	1.50*** (0.339)	1.42*** (0.342)
expt	0.13* (0.073)	0.22*** (0.079)	0.22*** (0.079)	0.13* (0.073)	0.22*** (0.079)	0.23*** (0.079)	0.13* (0.073)	0.21*** (0.079)	0.22*** (0.079)	0.13* (0.073)	0.22*** (0.079)	0.22*** (0.079)
profit	0.00 (0.000)	-0.00 (0.000)	-0.00 (0.000)	0.00 (0.000)	-0.00 (0.000)	-0.00 (0.000)	0.00 (0.000)	-0.00 (0.000)	-0.00 (0.000)	0.00 (0.000)	-0.00 (0.000)	-0.00 (0.000)
inst_quality	0.05*** (0.008)	0.03*** (0.007)	0.04*** (0.008)	0.05*** (0.008)	0.03*** (0.007)	0.04*** (0.008)	0.05*** (0.008)	0.03*** (0.007)	0.04*** (0.008)	0.04*** (0.008)	0.03*** (0.007)	0.04*** (0.008)
Constant	-6.78*** (0.534)	-6.32*** (0.720)	-7.10*** (0.775)	-6.75*** (0.534)	-6.29*** (0.720)	-7.06*** (0.776)	-6.81*** (0.534)	-6.25*** (0.711)	-7.11*** (0.766)	-6.68*** (0.537)	-6.25*** (0.696)	-7.06*** (0.753)
Observations	7373	7371	7371	7372	7370	7370	7373	7371	7371	7350	7349	7349
Time effect	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES
Sector Effect	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Pseudo R2	0.233	0.268	0.271	0.233	0.268	0.271	0.235	0.270	0.273	0.235	0.270	0.273

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table 6
Estimation results of sub-sample by credit constraints.

Variables	Credit constraint			
	(1)		(2)	
	No	Yes	No	Yes
DGBri	0.17*** (0.050)	0.14* (0.077)		
lnGBri			0.52*** (0.124)	0.02 (0.237)
lnCap	0.15*** (0.021)	0.20*** (0.035)	0.15*** (0.021)	0.20*** (0.035)
lnfirm	0.38*** (0.033)	0.28*** (0.053)	0.40*** (0.033)	0.30*** (0.053)
edu	0.01 (0.044)	0.05 (0.080)	0.01 (0.044)	0.05 (0.080)
labskill	0.84** (0.367)	1.92*** (0.538)	0.83** (0.367)	2.02*** (0.538)
expt	0.00 (0.089)	0.27** (0.121)	-0.00 (0.089)	0.29** (0.122)
profit	0.00 (0.001)	0.00 (0.001)	0.00 (0.001)	0.00 (0.001)
inst_quality	0.04*** (0.008)	0.03** (0.014)	0.04*** (0.009)	0.03* (0.014)
Constant	-5.73*** (0.556)	-5.54*** (0.942)	-5.61*** (0.560)	-5.23*** (0.942)
Observations	5411	1962	5397	1953
Pseudo R2	0.203	0.208	0.203	0.208

Robust standard errors in parentheses.

- *** p < 0.01.
- ** p < 0.05.
- * p < 0.1.

Source: Authors' calculation.

Regarding the effects of firm bargaining power, we also consider whether the fact that firms register their businesses contributes to their bargaining power vis-à-vis public officials. We label these firms as *Formal and Informal*. Table B.3 in Appendix B reports the estimation results. The findings highlight the fact that “greasing-the-wheels” of environmental innovation only holds for firms that formally register. We do not find similar evidence for informal firms. Paying greasing bribes

raises EI probability by 0.15%. The relationship between EI and the percentage of total annual revenue paid as greasing bribes is positive and statistically significant. These findings support hypothesis H3 that formally registered firms have a stronger bargaining power vis-à-vis public officials, and thus enjoy more benefits from their paid bribes. Therefore, they are more likely to invest more in EI.

Subsequently, we investigate the impact of credit constraints on the association between greasing bribery and EI decisions and report the results in Table 6. We find evidence that credit constraint hinders the motivation to implement EI in Vietnam. For firms with credit constraints, the effects of greasing bribery on EI probability are smaller than for those without credit constraints. In particular, the probability of EI increases by 0.14% for firms having difficulties with accessing credit compared to 0.17% for those who can access credit easily. This result supports hypothesis H4 that the utility of bribery is reduced for firms with credit constraints. One explanation for this is that the credit issue is important for SME survival. Firms in developing economies are in a constant battle for adequate funding. Firms with credit accessibility issues will try to focus their bribery efforts on the problems at hand, leaving innovation projects (including environmental innovation) lower on their agenda. On the other hand, firms with proper credit access could free up their financial and political resources to concentrate on innovation. Regarding the bribery amount, an increase in the share of revenue paid as informal payments only drives the EI probability of firms facing no credit constraint.

For further investigation of the mediating role of credit constraint, we follow Casey and O’Toole (2014) and break down the data into groups of different types of credit issues. The results are shown in Table 7. We use two variables to indicate whether a firm has credit demand: (1) if the firm applies for a formal loan; and (2) if the firm indicates it needs a loan. In both cases, the effect of bribery on EI probability is lower in firms with higher credit demand. For firms that do not need to apply for loans, greasing bribes increase their probability of engaging in EI by 0.18% compared to an increase of 0.14% in firms that applied for formal loans. Similar results are observed when we use firms’ self-professed demand for loans as the criteria. In firms that indicate that they do not need any more loans, greasing bribes increase their probability of engaging in EI by 0.23% compared to 0.19% in firms that apply

Table 7
Bribery and environmental innovation with a breakdown of credit issues.

Variables	Applied for a loan				Required loan				Discouraged borrower			
	No		Yes		No		Yes		No		Yes	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
DGBri	0.18*** (0.050)	0.14** (0.071)			0.23*** (0.074)	0.19** (0.089)			0.17*** (0.052)	0.14** (0.067)		
lnGBri			0.43*** (0.123)	0.53** (0.217)			0.61*** (0.171)	0.60** (0.270)			0.45*** (0.147)	0.46*** (0.159)
lnCap	0.15*** (0.020)	0.26*** (0.033)	0.16*** (0.020)	0.26*** (0.033)	0.24*** (0.031)	0.21*** (0.041)	0.25*** (0.031)	0.21*** (0.041)	0.23*** (0.023)	0.12*** (0.026)	0.23*** (0.023)	0.12*** (0.026)
lnfirm	0.36*** (0.034)	0.28*** (0.046)	0.39*** (0.034)	0.29*** (0.047)	0.29*** (0.049)	0.34*** (0.058)	0.32*** (0.049)	0.36*** (0.058)	0.27*** (0.034)	0.43*** (0.044)	0.29*** (0.034)	0.45*** (0.044)
edu	-0.01 (0.044)	0.05 (0.079)	-0.01 (0.044)	0.05 (0.080)	0.03 (0.073)	0.04 (0.099)	0.03 (0.074)	0.03 (0.100)	0.00 (0.051)	0.01 (0.057)	-0.01 (0.052)	0.01 (0.058)
labskill	1.34*** (0.362)	1.03** (0.480)	1.30*** (0.367)	1.08** (0.480)	1.32** (0.529)	1.68*** (0.583)	1.39*** (0.525)	1.72*** (0.583)	1.42*** (0.362)	0.93* (0.486)	1.41*** (0.365)	0.93* (0.491)
expt	0.14 (0.096)	0.10 (0.100)	0.11 (0.096)	0.11 (0.101)	0.26** (0.122)	0.02 (0.122)	0.27** (0.122)	0.04 (0.123)	0.14* (0.081)	0.06 (0.133)	0.13 (0.082)	0.05 (0.133)
inst_quality	0.04*** (0.010)	0.07*** (0.014)	0.04*** (0.010)	0.06*** (0.014)	0.07*** (0.017)	0.08*** (0.020)	0.07*** (0.017)	0.06*** (0.018)	0.06*** (0.010)	0.03** (0.013)	0.06*** (0.010)	0.02* (0.013)
Constant	-3.26*** (0.222)	-3.95*** (0.405)	-3.28*** (0.222)	-3.95*** (0.410)	-4.00*** (0.373)	-3.78*** (0.496)	-4.03*** (0.374)	-3.78*** (0.502)	-3.60*** (0.264)	-3.20*** (0.288)	-3.58*** (0.266)	-3.25*** (0.290)
Observations	5589	2029	5565	2002	2668	1330	2651	1316	4146	3473	4109	3459
Pseudo R2	0.176	0.212	0.175	0.214	0.247	0.232	0.248	0.233	0.204	0.176	0.204	0.177

Robust standard errors in parentheses.

- *** p < 0.01.
- ** p < 0.05.
- * p < 0.1.

Source: Authors' calculation.

for loans.

Another common credit issue for SMEs in developing economies is discouraged borrowers. These are firms that previously applied for loans, or even those that have their application accepted but then decide to not receive the loans and not to apply for other loans due to the high cost or difficult process. Casey and O'Toole (2014) call this incidence a form of price-based rationing from banks/credit institutions. In this dataset, being a discouraged borrower also reduces the effect that greasing bribes have on EI probability. For firms that are discouraged borrowers, greasing bribes will increase their probability of engaging in EI by 0.14% compared to 0.17% in firms that are not discouraged. Regarding bribery amount, an increase in the share of revenue paid as informal payments increases the EI probability of firms in all sub-samples, which also supports hypothesis H4. The magnitude of the estimates is the same for all sub-samples across all the measures of credit issues.

Next, we consider the role of institutional constraints in EI decision-making. As the paper introduces two types of institutional constraints, to examine the aggregate effect we created a dummy variable *Institutional* that takes the value of 1 if a firm faces at least one type of institutional constraint, and 0 otherwise. We re-estimate each sub-sample of the *Institutional* variable. Table B.4 in Appendix B reports the results. The results show that the incentive to implement EI rises when bribing firms face at least one institutional constraint. The magnitude of the effects from variables *DGBri* and *lnGBri* increases from 0.15% and 0.38% to 0.18% and 0.60%, respectively. These results provide evidence to support hypothesis H5b in the case of Vietnam. In other words, bribes are seen as an accepted pathway to success (Ufere et al., 2012) or a mechanism to reduce uncertainty and informational asymmetries about innovation implementation.

In further analysis, we control for both firm size and institutional constraints. Table B.5 in Appendix B shows the results. Similar conclusions on the effects of institutional constraints are found in Table B.5, whereby firms are more likely to implement EI if they face at least one institutional constraint. This applies to both micro- and small-sized firms. Table B.5 also highlights the differences between decisions regarding paying bribes and the changes in bribe payments for micro- and small-sized firms. The probability of EI is higher for micro-sized

firms when they decide to pay bribes. However, the effect of an increase in bribe payments on EI decisions is more sizable for small-sized firms when they face no constraints. The effects are not distinct in the case where firms face at least one constraint. The findings imply that larger-sized firms may derive more benefit from bribery when they do not encounter institutional constraints.

In the next step, we separately consider two specific types of institutional constraints: policy uncertainty, and unfair competition. The results are outlined in Table 8. We find no effect of greasing bribery on EI decisions for firms considering government policy uncertainty as a major constraint to their growth. If government policies do not obstruct firms' business operations, the probability of EI increases by 0.16% if the firms decide to pay greasing bribes. Conversely, the effects of greasing bribery on EI probability are amplified if there is an issue of unfair competition within the markets. The impact of greasing bribes increases from 0.14% to 0.21% for firms that do not perceive unfair competition as a major obstacle and those that do, respectively. Similar findings can be found when we use the share of revenue paid as informal payments (*lnGBri*). In general, the effect of institutional constraints is conditional on specific types of constraint that firms perceive as the major barrier to their growth.

We further control for firm size and credit constraints as well as institutional constraints and report the results in Tables B.6 and B.7 in Appendix B. We provide empirical evidence to support the view that the impact of bribery on EI probability is higher for small-sized firms in the case of no credit constraints. While the effects of *DGBri* are positive but only statistically significant for micro-sized firms, the bribery amount *lnGBri* increases EI probability by 0.61 and 0.44 for the sub-sample of micro-sized and small-sized firms, respectively. In the case of firms with credit constraints, we do not find any effects of bribery on EI decisions for both micro- and small-sized firms. The results advocate our previous findings that credit constraint hinders the motivation to implement EI in Vietnam.

Similarly, Table B.7 summarizes the estimation results when we control for both firm size and institutional constraints. We compare the effects of greasing bribery on the probability of EI between micro- and small-sized firms facing policy uncertainty and unfair competition, and results are reported in Panels A and B, respectively. As shown in Panel A,

Table 8
Estimation results of sub-sample by institutional constraints.

Variables	Policy uncertainty				Unfair competition			
	No	Yes	No	Yes	No	Yes	No	Yes
DGBri	0.16*** (0.042)	-0.17 (0.314)			0.14*** (0.046)	0.21** (0.095)		
lnGBri			0.42*** (0.110)	0.96 (0.673)			0.37*** (0.127)	0.63*** (0.212)
lnicap	0.18*** (0.018)	0.08 (0.098)	0.18*** (0.018)	0.08 (0.102)	0.16*** (0.020)	0.24*** (0.040)	0.16*** (0.020)	0.24*** (0.040)
lnfirm	0.33*** (0.028)	0.55*** (0.175)	0.36*** (0.028)	0.54*** (0.174)	0.34*** (0.030)	0.30*** (0.068)	0.36*** (0.030)	0.32*** (0.068)
edu	0.00 (0.039)	0.33 (0.262)	0.00 (0.039)	0.27 (0.302)	0.01 (0.043)	-0.01 (0.088)	0.01 (0.043)	-0.02 (0.088)
labskill	1.20*** (0.303)	0.98 (2.350)	1.21*** (0.303)	0.87 (2.403)	1.22*** (0.337)	1.25* (0.675)	1.23*** (0.335)	1.25* (0.682)
expt	0.12 (0.072)	-0.06 (0.521)	0.12* (0.072)	-0.12 (0.504)	0.16** (0.078)	-0.16 (0.177)	0.16** (0.079)	-0.16 (0.177)
profit	0.00 (0.000)	0.00 (0.003)	0.00 (0.001)	0.00 (0.003)	-0.00 (0.000)	0.01*** (0.003)	-0.00 (0.000)	0.01*** (0.004)
Constant	-3.38*** (0.197)	-4.61*** (1.470)	-3.39*** (0.198)	-4.52*** (1.642)	-3.30*** (0.217)	-3.77*** (0.445)	-3.30*** (0.218)	-3.75*** (0.444)
Observations	7244	129	7221	129	5804	1569	5786	1564
Pseudo R2	0.199	0.292	0.199	0.302	0.190	0.254	0.190	0.256

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

the number of firms that perceive government policy uncertainty as a major obstacle to growth is quite small in our sample. Our results indicate that the effects of bribery are only evident in an economy without policy uncertainty. On the other hand, these effects become more pronounced for larger-sized firms. This variable is statistically significant in the sub-samples. As discussed previously, larger-sized firms have stronger bargaining power which allows them to attain more preferential regulations and lower transaction costs (Galang, 2012). These advantages cause innovation activities to be more attractive commercially (Luo, 2004), and therefore larger, they are more likely to implement EI. However, our results suggest that bureaucratic inefficiencies caused by policy uncertainty may cancel these advantages, reducing the EI motivation of larger-sized firms. In other words, the advantages of larger enterprises in using bribes to promote environmentally innovative activities are only evident in the absence of policy uncertainty. The results in Panel B reinforce the conclusion on the impact of firm size on the marginal effects of greasing bribery in the economy characterized by unfair competition.

To conduct robustness checks on the changes in the relationship between bribery and the probability of EI implementation for firms being institutionally constrained, we use PCI data to represent current status and recent changes in the business environment in Vietnam across provinces and cities, instead of firm perception on the weak institutions and institutional constraints. We follow Malesky and Pham (2020) to define the “low” and “high quality” of institutions based on PCI. Specifically, we generate the dummy variable (*InstitutionalQuality*) that takes the value of 1 if PCI is greater than the mean value of PCI of Vietnam’s provinces and cities in a respective year. We regress the baseline model using the sub-sample by institutional quality based on PCI and report the estimation results in Table 9. Our results indicate that the effects of greasing bribery on EI decisions become more sizable for firms operating in areas of high institutional quality. To perform further analysis, we also employ subindices of the PCI index and use the same approach to define the “low” and “high” of corresponding subindices. In this analysis, we only concentrate on the subindices that are more likely to be relevant to EI decisions. In general, our findings still hold as presented in Table B.8. In particular, the probability of EI implementation increases if these firms operate in areas where there is: (i) transparent business environment and equitable business information; (ii) low informal costs as informal charges as well as time costs as time requirements for bureaucratic procedures and inspections; (iii) fair competition as minimal crowding out of private activity from policy biases toward state, foreign, or connected firms; and (iv) more proactive and creative provincial leadership in solving firms’ problems.

5.2. Sector Variation

In further analysis, we investigate the effect of bribery on EI decisions across sectors. Based on the taxonomy of Tomiura (2007), firms can be classified into three sector groups: supplier-dominated sector, scale-intensive sector, and science-based sector.¹⁷ We use the same model specification for these groups and provide estimation results in Table 10. In our sample, there are 4947 firms, 2174 firms, and 1690 firms classified as being in a supplier-dominated sector, scale-intensive sector, and science-based sector, respectively. The effects of bribery on EI decisions are strongest in the science-based sector, followed by the scale-intensive sector. In contrast, the relationship between bribery and EI decisions is quite small in the supplier-dominated sector. The results

¹⁷ Supplier-dominated sector includes agriculture; food and beverages; tobacco; textiles; apparel; leather; wood; paper; publishing and printing; furniture; jewelry; and music equipment. Scale-intensive sector includes refined petroleum; rubber; non-metallic mineral products; basic metals; and fabricated metal products. Science-based sector includes chemical products; fabricated metal products; electronic machinery; computers; radio; and motor vehicles.

might suggest that firms belonging to the science-based sector use bribery as a tool to facilitate EI. As argued by Cuerva et al. (2014), technological capacities and human capital are essential drivers of EI that are more radical compared to conventional innovation (Hemmel-skamp, 1999). Firms with inadequate levels of technological capacity and human capital face difficulties in developing EI. In this regard, the effects of bribery on EI become more pronounced for firms belonging to the science-based sector. Table 10 also reveals that the estimates for other variables remain stable across sectors.

5.3. IV Estimation

Up to now, we have abstracted the fact that the bribery variable may be endogenous. In this section, we address this problem by employing the IV method. Like Nguyen et al. (2017), we use sector-province average bribing rates as our instrument. We re-examine the effects of rent-seeking and greasing bribery using instrumental variable probit models. We construct four new instruments: *RBri_ivb*, *GBri_ivb*, *RBri_ivr* and *GBri_ivr*, corresponding to four key explanatory variables: *DRBri*, *DGBri*, *lnRBri* and *lnGBri*. We also use firm attitude toward the level of system corruption (proxied by the trend of bribe amounts) as the other instruments. Firms were asked to provide the reasons to explain the belief that they have to pay higher communication/informal fees due to “difficulties to comply with the government regulation” (*gov_reg*) or “introduction of new product and process” (*newpro_dif*). These two instrumental variables are employed in all models.

Subsequently, we conduct endogeneity tests for the validity of the instrumental variables and report the results in Table 11. First, the Hausman tests of endogeneity display significant χ^2 in the model using the rent-seeking bribery variables (*DRBri* and *lnRBri*) but non-significant χ^2 in the model using the greasing bribery variables (*DGBri* and *lnGBri*). The latter results imply that the endogeneity of greasing bribery and environmental innovation is not an issue in our sample. However, the potential endogeneity should not be abstracted given the strong theoretical discussion, as we revealed. Second, the Sargan tests of over-identification illustrate that χ^2 statistics are not significant, implying that the hypothesis that the instrumental variables are valid cannot be rejected. The Lagrange Multiplier (LM) statistics of under-identification tests demonstrate that χ^2 statistics are significant, implying that the instrumental variables are relevant. Finally, we report the significant Cragg-Donald Wald F-statistic, suggesting that our instrumental variables have adequate power in mitigating the endogeneity issue. These tests provide evidence to confirm that our instrumental variables are valid and pertinent.

In the following analysis, we use 2SLS to estimate the model. In addition to the common variables such as *gov_reg* and *newpro_dif*, we employ *RBri_ivb*, *GBri_ivb*, *RBri_ivr* and *GBri_ivr* corresponding to the four key explanatory variables: *DRBri*, *DGBri*, *lnRBri* and *lnGBri*. Table 12 reports the results of the first-stage and second-stage of IV regression on the sub-sample by the form of bribe. In the first-stage model, represented in Columns 2, 4, 6, and 8 of Table 12, the coefficients of the four instrumental variables *RBri_ivb*, *GBri_ivb*, *RBri_ivr* and *GBri_ivr* are significant at $p < 0.001$ level. The instruments *gov_reg* and *newpro_dif* are only statistically significant in the model with greasing bribery. The predicted values of bribes are put in the second-stage model and displayed in Columns 1, 3, 5, and 7 of Table 12. Similar to the result of the simple probit model in Table 5, our hypotheses H1a and H1b regarding the effects of rent-seeking and greasing bribery still hold. The signs of all coefficients are consistent with our previous estimations; however, the magnitude of these variables becomes much more sizable. In short, the results of this analysis firmly reinforce our main conclusions that greasing bribery is known to “grease-the-wheels” of EI, whereas rent-seeking bribery is known to “sanding-the-wheels” of EI. When fixing the endogeneity problem, the influence of bribery on EI decisions is significantly greater.

Table 9
Estimation results by institution quality using PCI index.

Variables	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Rent-seeking Bribery				Greasing Bribery											
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High				
DRBri	-0.07 (0.127)	-0.24* (0.126)														
lnRBri			0.28 (0.360)	-0.50 (0.313)												
DGBri									0.15*** (0.059)	0.17*** (0.057)						
lnGBri													0.39** (0.169)	0.43*** (0.144)		
lnCap	0.16*** (0.025)	0.18*** (0.025)	0.16*** (0.025)	0.18*** (0.025)	0.16*** (0.025)	0.18*** (0.025)	0.16*** (0.025)	0.18*** (0.025)	0.16*** (0.025)	0.18*** (0.025)	0.16*** (0.026)	0.18*** (0.026)	0.16*** (0.026)	0.18*** (0.026)	0.18*** (0.025)	0.18*** (0.025)
lnfirm	0.46*** (0.038)	0.24*** (0.037)	0.46*** (0.038)	0.24*** (0.037)	0.46*** (0.038)	0.24*** (0.037)	0.44*** (0.038)	0.23*** (0.038)	0.46*** (0.038)	0.23*** (0.038)	0.46*** (0.038)	0.23*** (0.038)	0.46*** (0.038)	0.25*** (0.038)	0.25*** (0.038)	0.25*** (0.038)
edu	0.08 (0.066)	0.01 (0.047)	0.08 (0.066)	0.01 (0.047)	0.08 (0.066)	0.01 (0.047)	0.07 (0.066)	0.00 (0.047)	0.07 (0.066)	0.00 (0.047)	0.07 (0.066)	0.00 (0.047)	0.07 (0.066)	0.00 (0.048)	0.00 (0.048)	0.00 (0.048)
labskill	1.53*** (0.409)	1.07*** (0.402)	1.48*** (0.410)	1.07*** (0.402)	1.43*** (0.411)	1.01*** (0.403)	1.37*** (0.415)	1.06*** (0.407)	1.37*** (0.415)	1.01*** (0.403)	1.37*** (0.415)	1.06*** (0.407)	1.37*** (0.415)	1.06*** (0.407)	1.06*** (0.407)	1.06*** (0.407)
expt	-0.06 (0.099)	0.38*** (0.101)	-0.05 (0.099)	0.39*** (0.101)	-0.07 (0.099)	0.38*** (0.100)	-0.08 (0.100)	0.37*** (0.101)	-0.07 (0.099)	0.38*** (0.100)	-0.08 (0.100)	0.37*** (0.101)	-0.08 (0.100)	0.37*** (0.101)	0.37*** (0.101)	0.37*** (0.101)
Constant	-3.87*** (0.324)	-3.07*** (0.256)	-3.86*** (0.325)	-3.05*** (0.256)	-3.83*** (0.325)	-3.07*** (0.257)	-3.85*** (0.326)	-3.05*** (0.258)	-3.87*** (0.324)	-3.07*** (0.256)	-3.85*** (0.326)	-3.05*** (0.258)	-3.87*** (0.324)	-3.07*** (0.256)	-3.85*** (0.258)	-3.05*** (0.258)
Observations	4608	3011	4605	3008	4608	3011	4580	2988	4608	3011	4580	2988	4608	3011	4580	2988
Pseudo R2	0.261	0.138	0.261	0.139	0.263	0.140	0.263	0.139	0.263	0.140	0.263	0.139	0.263	0.139	0.263	0.139

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table 10
Estimation results of sub-sample by sectors.

Variables	Supplier-dominated	Scale-intensive	Science-based	Supplier-dominated	Scale-intensive	Science-based
	EI	EI	EI	EI	EI	EI
DGBri	0.12*** (0.053)	0.20*** (0.078)	0.28*** (0.093)			
lnGBri				0.31** (0.139)	0.68*** (0.213)	0.69*** (0.232)
lnCap	0.15*** (0.023)	0.18*** (0.034)	0.17*** (0.042)	0.16*** (0.022)	0.18*** (0.034)	0.18*** (0.043)
lnfirm	0.26*** (0.036)	0.49*** (0.051)	0.48*** (0.068)	0.27*** (0.036)	0.52*** (0.051)	0.52*** (0.068)
edu	0.07 (0.048)	-0.10 (0.071)	-0.00 (0.096)	0.07 (0.048)	-0.10 (0.072)	0.00 (0.097)
labskill	1.96*** (0.417)	0.34 (0.536)	0.28 (0.590)	1.97*** (0.416)	0.35 (0.537)	0.26 (0.597)
expt	0.17** (0.087)	0.15 (0.162)	-0.06 (0.182)	0.18** (0.087)	0.16 (0.161)	-0.05 (0.181)
profit	0.00 (0.001)	-0.00 (0.001)	-0.00 (0.001)	0.00 (0.001)	-0.00 (0.001)	-0.00 (0.001)
inst_quality	0.05*** (0.009)	0.04*** (0.014)	0.04*** (0.016)	0.04*** (0.009)	0.03** (0.014)	0.04** (0.016)
Constant	-6.11*** (0.595)	-5.66*** (0.930)	-5.92*** (1.082)	-6.04*** (0.599)	-5.26*** (0.929)	-5.89*** (1.083)
Observations	4849	2133	1657	4835	2126	1651
Pseudo R2	0.194	0.242	0.250	0.193	0.243	0.250

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

6. Conclusion

This paper is an attempt to seek an answer to the question of whether bribery promotes or harms firms' environmental innovation in the case of a developing country like Vietnam. We use SME survey data in

Vietnam from 2011 to 2015 to provide empirical evidence to support the "greasing-the-wheels" of the environmental innovation hypothesis, while rent-seeking bribery has a negative effect (the "sanding-the-wheels" hypothesis). The results show that the effects of distinct forms of bribery on EI decisions are heterogeneous. The data indicates that using

Table 11
Endogeneity test.

Bribes (First stage model)	Coefficient			
	DRBri	DGBri	lnRBri	lnGBri
Hausman test of endogeneity (χ^2)	5.37 (0.021)	0.028 (0.865)	3.307 (0.069)	0.203 (0.652)
Sargan χ^2 statistics	3.11	2.87	3.34	4.12
(Over-identification test)	(0.211)	(0.238)	(0.188)	(0.128)
Anderson Canon.Corr. LM statistic	464.82	904.55	316.34	460.19
(Under-identification test)	(0.000)	(0.000)	(0.000)	(0.000)
Cragg-Donald Wald F-statistic	175.16 (0.000)	390.22 (0.000)	114.34 (0.000)	173.29 (0.000)

Note: we report endogeneity tests of bribes on environmental innovation from the specification using Two-Stage least squares (2SLS) regression. P-values are in brackets.

greasing bribery has a significant positive effect on the probability that a firm decides to pursue environmental innovation. Since EI is a long and complex process that requires a high level of technological capacity and human capital, greasing bribery to get things done regarding licenses, taxes, regulations or services can be seen as a prerequisite of successful environmental innovation, especially in a weak institutional environment like Vietnam. In particular, the effect of bribery is stronger for larger-sized, formally registered firms or those facing no credit

Table 12
IV estimation.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage
	EI	DRBri	EI	DGBri	EI	lnRBri	EI	lnGBri
DRBri	-0.66** (0.288)							
DGBri			0.25*** (0.085)					
lnRBri					-1.11 (0.862)			
lnGBri							0.85*** (0.325)	
lnicap	0.18*** (0.017)	0.00 (0.001)	0.17*** (0.018)	0.00 (0.004)	0.17*** (0.018)	0.00 (0.001)	0.17*** (0.018)	0.00** (0.001)
lnfirm	0.34*** (0.029)	0.01*** (0.004)	0.31*** (0.030)	0.06*** (0.008)	0.33*** (0.028)	-0.00 (0.001)	0.33*** (0.029)	-0.01*** (0.003)
edu	0.02 (0.038)	-0.00 (0.003)	0.00 (0.038)	0.02** (0.007)	0.01 (0.038)	0.00 (0.002)	0.00 (0.039)	0.01*** (0.002)
labskill	1.34*** (0.300)	0.07 (0.044)	1.12*** (0.305)	0.26*** (0.090)	1.29*** (0.300)	0.01 (0.018)	1.13*** (0.305)	0.09** (0.035)
expt	0.09 (0.073)	-0.01 (0.011)	0.09 (0.072)	0.03 (0.023)	0.10 (0.072)	0.00 (0.006)	0.09 (0.072)	0.02** (0.009)
profit	0.00*** (0.002)	-0.00 (0.000)	0.01*** (0.002)	0.00 (0.001)	0.00*** (0.002)	-0.00*** (0.000)	0.01*** (0.002)	-0.00*** (0.000)
gov_reg		-0.01 (0.009)		0.44*** (0.013)		0.00 (0.004)		0.06*** (0.008)
newpro_dif		0.13 (0.088)		0.29*** (0.102)		0.02 (0.013)		0.04 (0.055)
RBri_ivb		0.96*** (0.065)						
GBri_ivb				0.74*** (0.021)				
RBri_ivr						0.91*** (0.187)		
GBri_ivr								0.95*** (0.057)
Constant	-3.34*** (0.193)	-0.02* (0.014)	-3.32*** (0.196)	-0.17*** (0.036)	-3.33*** (0.194)	-0.00 (0.010)	-3.33*** (0.197)	-0.05*** (0.013)
Observations	7373	7373	7373	7373	7372	7372	7350	7350
Pseudo R2	0.0592	0.0592	0.189	0.189	0.317	0.317	0.206	0.206

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

constraints, while different types of institutional constraints also have a different effect on the magnitude of the impact. Other analysis also provides evidence that firms that utilize greasing bribery only as a tool to facilitate real investment in environmental innovation do not consider these bribes as a substitute for actually fixing environmental issues. On the other hand, using rent-seeking bribes, which involves competition among bribe givers for favors from the government, requires larger investment from firms while the benefits are often uncertain. The regression finds evidence that involvement in these types of bribery does increase the chance that firms take environmental innovation initiatives.

The findings of this study suggest some important insights into the incentive of firms regarding their decision to invest in EI. While any form of bribery is detrimental to the development of the business sector as a whole, in developing countries characterized by weak and poor institutions, the existence of corruption is pervasive and could not be eradicated by any policies in the near future. Therefore, taking account of the influence of the various forms of bribery as shown in this study is necessary to formulate relevant policies that promote environmental innovation in SMEs.

One thing these governments could realistically enforce is to make sure that those firms that acquire EI certificates (whether or not by utilizing greasing bribes) actually invest in environmental innovation activities instead of simply "buying" the certificates to bypass

government scrutiny and not doing any EI activities. We recommend that the government involves the private sector in the process of granting and supervising these certificates, which would improve the transparency as well as the credibility of the government agency and reduce the transaction cost on the part of the enterprises.

Another of our conclusions is that credit constraints and institutional constraints reduce the effects of bribery as well as negatively affect EI activities. To boost the rate of EI adoption, the government must focus on alleviating credit and institutional issues. In these aspects, significant improvement in environmental innovation would require: (1) having a strong financial system with adequate attention to businesses, especially those of micro- and small-size; (2) fair competition in the markets; (3) and stable and transparent policy-making process.

On a longer-term basis, the government should focus on the root causes of bribery, which are the inefficiencies in the bureaucratic system; namely, the loopholes in the law and regulation as well as imbalance in the supply and demand of bureaucratic services, which often leads to long delays and high informal costs. The government needs to

implement administrative reforms and promote transparency as well as policies encouraging the establishment of joint projects between public agencies and private companies. Furthermore, it is imperative to stabilize the political system and ensure fair competition in the domestic market. We strongly recommend an improvement in the monitoring system involving non-government or private agencies. Lastly, the implementation of EI is a long and complex process that requires firms to possess high levels of technical and financial capability. Therefore, government support packages, such as a financial stimulus, technical assistance, consultant support for implementation, and a workable administration process, are essential to encouraging firms to pursue environmental innovation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Variable Description

Table A

Variable description and measurement.

Variable name	Description	Measurement
EI	Environmental innovation	Dummy variable that takes the value of 1 if firms have a certificate for registration of satisfaction for environmental standards
DRBri	Rent-seeking bribe dummy	Dummy variable that takes the value of 1 if firm used rent-seeking bribery
lnRBri	Rent-seeking bribe amount	Log of rent-seeking bribery as share of firm revenue
DGBri	Greasing bribe dummy	Dummy variable that takes the value of 1 if firm used greasing bribery
lnGBri	Greasing bribe amount	Log of greasing bribery as share of firm revenue
lnCap	Log of physical capital	Log of the value of real physical assets of the firm measured at the end of the previous calendar year
labskill	Log of number of skilled workers	Log of the number of skilled workers (workers with professional training at university or college level) at the firm at the end of the previous calendar year
educ	Educational level of the owner	Educational level of the owner. The categories for this variable include: No education (1), Not finished primary (2), Finished primary (3), Finished lower secondary (4), Finished upper secondary (5)
expt	Export dummy	Dummy variable that takes the value of 1 if the firm participated in export activities (directly or indirectly).
lnfirm	Log of number of full-time regular workers	Log of the number of full-time regular employees at the firm measured at the end of the previous calendar year.
profit	Firm gross profit	The real gross profit of the previous year (measured in 2010 VND)
ins_quality	Institutional quality	The provincial competitiveness index for the province that the firm was located in
loanapl	Loan Application	Dummy variable that takes the value of 1 if firm applied for bank loans or other formal credit since last survey
reqloan	Require Loan	Dummy variable that takes the value of 1 if indicated it needs a loan to undertake its activities
discourage	Discourage borrowers	Dummy variable that takes the value of 1 if not applied for formal loans since last survey due to (1) Process too difficult or (2) Interest rate too high
pol_constrt	Political policy uncertainty	Dummy variable that takes the value of 1 if firm identified political policy uncertainty as one of the 3 most important constraints to growth
comp_constrt	Competition/unfair competition	Dummy variable that takes the value of 1 if firm identified too much competition/unfair competition as one of the 3 most important constraints to growth

Appendix B. Estimation Results of Further Analysis

Table B.1

Estimation results of sub-sample by size.

Variables	(1)	(2)	(3)	(4)
	Micro	Small	Micro	Small
DGBri	0.22 ^{*****} , *	0.08		
	(0.057)	(0.061)		
lnGBri			0.44 ^{***}	0.51 ^{***}
			(0.134)	(0.194)
lnCap	0.11 ^{***}	0.24 ^{***}	0.11 ^{***}	0.24 ^{***}
	(0.024)	(0.028)	(0.024)	(0.028)
edu	0.02	0.08	0.02	0.08
	(0.044)	(0.083)	(0.044)	(0.083)
labskill	0.63	1.28 ^{***}	0.64	1.26 ^{***}
	(0.496)	(0.406)	(0.500)	(0.406)
expt	0.01	0.12	0.01	0.12
	(0.207)	(0.077)	(0.206)	(0.078)
profit	0.01	0.00	0.01	0.00

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Table B.1 (continued)

Variables	(1)	(2)	(3)	(4)
	Micro	Small	Micro	Small
inst_quality	(0.007) 0.06*** (0.010)	(0.000) 0.01 (0.011)	(0.006) 0.06*** (0.010)	(0.000) 0.01 (0.011)
Constant	-7.00*** (0.634)	-4.52*** (0.790)	-6.90*** (0.637)	-4.35*** (0.795)
Observations	5254	2119	5239	2111
Pseudo R2	0.100	0.0919	0.0967	0.0925

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table B.2

Estimation results of sub-sample by profit status.

Variables	(1)	(2)	(3)	(4)
	Greasing bribery			
	Profit	Loss	Profit	Loss
DGBri	0.16*** (0.041)	-0.03 (0.360)	0.41*** (0.109)	0.49 (1.153)
lnGBri				
lnCap	0.17*** (0.018)	-0.07 (0.180)	0.17*** (0.018)	-0.06 (0.181)
lnfirm	0.35*** (0.027)	0.34 (0.242)	0.37*** (0.027)	0.35 (0.244)
edu	0.02 (0.038)		0.01 (0.039)	
labskill	1.25*** (0.290)	0.56 (2.863)	1.24*** (0.292)	0.67 (2.886)
expt	0.12* (0.070)	-0.18 (0.528)	0.11 (0.070)	-0.17 (0.527)
inst_quality	0.04*** (0.007)	0.18** (0.084)	0.03*** (0.007)	0.18** (0.086)
Constant	-5.58*** (0.469)	-12.28** (5.074)	-5.42*** (0.473)	-12.15** (5.083)
Observations	7531	75	7480	75
Pseudo R2	0.212	0.0995	0.212	0.102

Robust standard errors in parentheses.

Note: The estimation results of variable *edu* disappear from the Table due to an omitted observation. There are only 38 profit-losing firms that pay bribes and their owners only have a lower educational level (e.g., finish the primary and secondary only) in our sample.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table B.3

Estimation results of sub-sample by legal registration.

Variables	(1)	(2)	(3)	(4)
	Formal	Informal	Formal	Informal
DGBri	0.15*** (0.043)	-0.15 (0.192)		
lnGBri			0.40*** (0.114)	-0.84 (0.729)
lnCap	0.16*** (0.019)	0.11* (0.060)	0.16*** (0.019)	0.11* (0.060)
lnfirm	0.33*** (0.029)	0.24 (0.189)	0.35*** (0.029)	0.24 (0.192)
edu	-0.01 (0.041)	0.06 (0.120)	-0.01 (0.041)	0.06 (0.120)
labskill	1.00*** (0.304)		1.01*** (0.304)	
expt	0.11	0.03	0.12*	0.02

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Table B.3 (continued)

Variables	(1)	(2)	(3)	(4)
	Formal	Informal	Formal	Informal
profit	(0.072) 0.00 (0.000)	(0.504) -0.02 (0.075)	(0.072) 0.00 (0.001)	(0.504) -0.03 (0.074)
inst_quality	0.03*** (0.008)	0.01 (0.031)	0.03*** (0.008)	0.01 (0.031)
Constant	-4.83*** (0.515)	-4.25** (2.078)	-4.66*** (0.517)	-4.25** (2.058)
Observations	5701	1656	5682	1652
Pseudo R2	0.167	0.0813	0.167	0.0833

Robust standard errors in parentheses.

Note: The estimation results of variable *labskill* and *edu* disappear from the Table due to an omitted observation.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table B.4

Bribery and EI decisions for firms facing no institutional constraints or at least one institutional constraints.

Variables	(1)	(2)	(3)	(4)
	No constraint	At least 1 constraint	No constraint	At least 1 constraint
	EI	EI	EI	EI
DGBri	0.15*** (0.046)	0.18*** (0.088)		
lnGBri			0.38*** (0.127)	0.60*** (0.204)
lnCap	0.17*** (0.020)	0.24*** (0.036)	0.17*** (0.020)	0.24*** (0.036)
lnfirm	0.33*** (0.030)	0.37*** (0.058)	0.35*** (0.030)	0.40*** (0.058)
edu	0.01 (0.043)	0.00 (0.083)	0.01 (0.043)	-0.01 (0.085)
labskill	1.20*** (0.326)	1.39*** (0.613)	1.21*** (0.327)	1.29*** (0.631)
expt	0.18** (0.081)	-0.07 (0.168)	0.17** (0.081)	-0.07 (0.168)
Constant	-3.86*** (0.262)	-4.19*** (0.474)	-3.88*** (0.262)	-4.18*** (0.478)
Observations	5675	1698	5657	1693
Pseudo R2	0.216	0.279	0.216	0.284

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table B.5

Bribery and EI decisions with interaction between firms' size and firms facing no institutional constraint or at least one institutional constraint.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	No constraint		At least 1 constraint		No constraint		At least 1 constraint	
	Micro	Small	Micro	Small	Micro	Small	Micro	Small
DGBri	0.16** (0.064)	0.15*** (0.046)	0.36*** (0.120)	0.18** (0.088)				
lnGBri					0.38** (0.157)	0.38*** (0.127)	0.72*** (0.248)	0.60*** (0.204)
lnCap	0.12*** (0.026)	0.17*** (0.020)	0.24*** (0.047)	0.24*** (0.036)	0.12*** (0.026)	0.17*** (0.020)	0.24*** (0.046)	0.24*** (0.036)
lnfirm	0.44*** (0.080)	0.33*** (0.030)	0.19 (0.147)	0.37*** (0.058)	0.45*** (0.080)	0.35*** (0.030)	0.24* (0.148)	0.40*** (0.058)
edu	0.00 (0.049)	0.01 (0.043)	-0.03 (0.094)	0.00 (0.083)	0.00 (0.050)	0.01 (0.043)	-0.05 (0.093)	-0.01 (0.085)
labskill	0.70 (0.524)	1.20*** (0.326)	0.92 (0.968)	1.39** (0.613)	0.62 (0.534)	1.21*** (0.327)	1.02 (1.021)	1.29** (0.631)
expt	0.12	0.18**	0.06	-0.07	-0.01	0.17**	-0.11	-0.07

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Table B.5 (continued)

Variables	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		
	No constraint		At least 1 constraint		No constraint		At least 1 constraint		No constraint		At least 1 constraint		No constraint		At least 1 constraint		
	Micro	Small	Micro	Small	Micro	Small	Micro	Small	Micro	Small	Micro	Small	Micro	Small	Micro	Small	
Constant	(0.216) -3.32*** (0.260)	(0.078) -3.36*** (0.218)	(0.354) -3.68*** (0.504)	(0.151) -3.88*** (0.420)	(0.239) -3.30*** (0.259)	(0.078) -3.36*** (0.219)	(0.406) -3.61*** (0.494)	(0.151) -3.89*** (0.426)	Observations	4111	5875	1296	1744	4090	5837	1287	1731
Pseudo R2	0.0784	0.195	0.138	0.247	0.0742	0.195	0.132	0.249									

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table B.6

Bribery and EI decisions with credit constraints and size sub-sample.

Variables	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	No		Yes		Yes		No		No		Yes		Yes			
	Micro	Small	Micro	Small	Micro	Small	Micro	Small	Micro	Small	Micro	Small	Micro	Small		
DGBri	0.29*** (0.065)	0.08 (0.074)	0.19 (0.117)	0.13 (0.100)												
lnGBri					0.61*** (0.146)	0.44** (0.220)	-0.07 (0.325)	0.21 (0.379)								
lnCap	0.15*** (0.023)	0.30*** (0.031)	0.16*** (0.049)	0.30*** (0.041)	0.16*** (0.023)	0.30*** (0.032)	0.16*** (0.048)	0.30*** (0.042)								
edu	0.03 (0.048)	0.16 (0.102)	0.12 (0.101)	0.08 (0.132)	0.03 (0.049)	0.18* (0.104)	0.13 (0.102)	0.07 (0.136)								
labskill	0.92* (0.529)	0.93* (0.483)	1.78** (0.900)	1.90*** (0.668)	1.02* (0.536)	0.82* (0.486)	1.70* (0.935)	2.10*** (0.670)								
expt	0.12 (0.208)	0.16* (0.092)	0.40 (0.405)	0.34*** (0.119)	-0.02 (0.228)	0.16* (0.092)	0.30 (0.465)	0.35*** (0.119)								
inst_quality	0.07*** (0.011)	0.02 (0.013)	0.06*** (0.021)	0.01 (0.018)	0.06*** (0.011)	0.01 (0.013)	0.06*** (0.021)	0.01 (0.018)								
Constant	-6.95*** (0.694)	-4.75*** (0.946)	-7.14*** (1.364)	-4.41*** (1.341)	-6.85*** (0.703)	-4.78*** (0.963)	-6.88*** (1.363)	-4.00*** (1.346)								
Observations	4181	1424	1226	788	4159	1412	1218	779								
Pseudo R2	0.0980	0.0780	0.0928	0.0966	0.0944	0.0798	0.0781	0.0956								

Robust standard errors in parentheses.

Note: The estimation results of variable *expt* disappear from the Table due to an omitted observation.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Source: Authors' calculation.

Table B.7

Bribery and EI decision with breakdown of institutional constraints and size sub-sample.

Panel A: By policy uncertainty and firm size								
Variables	Policy uncertainty							
	No		Yes		No		Yes	
	Micro	Small	Micro	Small	Micro	Small	Micro	Small
DGBri	0.21*** (0.057)	0.10 (0.060)	-0.14 (0.744)	-0.67 (0.445)				
lnGBri					0.48*** (0.133)	0.49** (0.195)	-3.02 (1.980)	1.06 (0.915)
lnCap	0.14*** (0.023)	0.25*** (0.027)	0.29 (0.271)	0.01 (0.138)	0.14*** (0.023)	0.25*** (0.028)	0.36 (0.285)	0.08 (0.135)
lnfirm	0.39*** (0.071)	0.22*** (0.044)	0.81 (0.618)	0.47** (0.237)	0.41*** (0.071)	0.24*** (0.045)	0.71 (0.644)	0.48** (0.241)
labskill	0.66 (0.461)	1.43*** (0.390)		0.13 (2.523)	0.63 (0.473)	1.44*** (0.392)		-0.58 (2.660)
expt	0.15 (0.186)	0.13* (0.077)		0.30 (0.479)	0.01 (0.208)	0.13* (0.077)		0.18 (0.479)
Constant	-3.37*** (0.153)	-3.40*** (0.223)	-4.18*** (1.573)	-1.30 (1.453)	-3.36*** (0.151)	-3.45*** (0.226)	-4.40*** (1.587)	-2.49 (1.526)

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Table B.7 (continued)

Panel A: By policy uncertainty and firm size								
Variables	Policy uncertainty							
	No		Yes		No		Yes	
	Micro	Small	Micro	Small	Micro	Small	Micro	Small
Observations	5330	2158	28	54	5300	2137	28	54
Pseudo R2	0.0867	0.0936	0.172	0.115	0.0818	0.0949	0.209	0.101

Panel B: By unfair competition and firm size								
Variables	Unfair competition							
	No		Yes		No		Yes	
	Micro	Small	Micro	Small	Micro	Small	Micro	Small
DGBri	0.17*** (0.064)	0.10 (0.065)	0.37*** (0.124)	0.04 (0.140)				
lnGBri					0.38** (0.156)	0.56** (0.221)	0.72*** (0.249)	0.40 (0.387)
lnCap	0.12*** (0.025)	0.23*** (0.029)	0.24*** (0.048)	0.29*** (0.072)	0.12*** (0.026)	0.23*** (0.029)	0.25*** (0.047)	0.30*** (0.072)
lnfirm	0.44*** (0.079)	0.23*** (0.048)	0.18 (0.154)	0.25** (0.101)	0.45*** (0.079)	0.24*** (0.049)	0.24 (0.154)	0.27*** (0.103)
labskill	0.80 (0.510)	1.30*** (0.427)	0.52 (1.024)	1.92** (0.889)	0.74 (0.519)	1.34*** (0.429)	0.54 (1.088)	1.74* (0.909)
expt	0.07 (0.215)	0.20** (0.084)	0.20 (0.354)	-0.14 (0.174)	-0.05 (0.237)	0.19** (0.084)	0.03 (0.408)	-0.13 (0.173)
Constant	-3.31*** (0.172)	-3.33*** (0.241)	-3.77*** (0.327)	-3.76*** (0.549)	-3.30*** (0.170)	-3.37*** (0.245)	-3.80*** (0.324)	-3.86*** (0.556)
Observations	4190	1818	1218	394	4169	1801	1209	390
Pseudo R2	0.0801	0.0916	0.132	0.101	0.0759	0.0930	0.124	0.104

Robust standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Table B.8

Estimation results by subindices of PCI index.

Panel A												
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Transparency				Informal costs				Time costs			
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
DGBri	0.14** (0.062)	0.15*** (0.056)			0.27*** (0.052)	-0.03 (0.072)			0.24*** (0.056)	0.08 (0.062)		
lnGBri			0.36* (0.187)	0.38*** (0.138)			0.58*** (0.127)	0.09 (0.228)			0.62*** (0.139)	0.22 (0.172)
lnCap	0.17*** (0.028)	0.14*** (0.024)	0.17*** (0.028)	0.14*** (0.024)	0.15*** (0.023)	0.26*** (0.029)	0.15*** (0.023)	0.25*** (0.029)	0.15*** (0.025)	0.22*** (0.025)	0.16*** (0.025)	0.22*** (0.025)
lnfirm	0.41*** (0.041)	0.28*** (0.035)	0.43*** (0.041)	0.30*** (0.036)	0.33*** (0.032)	0.34*** (0.047)	0.36*** (0.032)	0.35*** (0.047)	0.39*** (0.036)	0.25*** (0.041)	0.43*** (0.036)	0.27*** (0.041)
edu	0.14** (0.068)	-0.05 (0.047)	0.14** (0.068)	-0.05 (0.047)	-0.05 (0.050)	0.10 (0.060)	-0.04 (0.050)	0.09 (0.061)	0.09 (0.063)	-0.01 (0.049)	0.08 (0.063)	-0.01 (0.049)
labskill	1.68*** (0.427)	0.87** (0.388)	1.60*** (0.429)	0.94** (0.393)	0.98*** (0.359)	1.61*** (0.486)	1.09*** (0.359)	1.45*** (0.497)	1.56*** (0.378)	0.64 (0.447)	1.57*** (0.380)	0.62 (0.453)
expt	-0.07 (0.104)	0.33*** (0.096)	-0.07 (0.104)	0.32*** (0.096)	0.14* (0.082)	0.10 (0.132)	0.14* (0.082)	0.05 (0.133)	0.05 (0.090)	0.25** (0.111)	0.04 (0.091)	0.24** (0.111)
Constant	-4.28*** (0.341)	-2.58*** (0.255)	-4.28*** (0.341)	-2.59*** (0.256)	-2.97*** (0.267)	-4.34*** (0.311)	-2.98*** (0.267)	-4.30*** (0.310)	-3.80*** (0.322)	-3.36*** (0.249)	-3.82*** (0.321)	-3.35*** (0.250)
Observations	4551	3068	4527	3041	4328	3291	4307	3261	4567	3052	4542	3026
Pseudo R2	0.268	0.130	0.267	0.130	0.162	0.282	0.160	0.281	0.234	0.184	0.234	0.183

Panel B												
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Fair competition				Proactive and creative provincial leadership				Fair and effective legal procedure			
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
DGBri	0.13* (0.068)	0.19*** (0.052)			0.07 (0.063)	0.22*** (0.055)			0.17*** (0.042)	0.14 (0.158)		

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Table B.8 (continued)

Panel B																									
Variables	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)		(12)		
	Fair competition				Proactive and creative provincial leadership								Fair and effective legal procedure												
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	
lnGBri			0.42**	0.39***										0.21	0.59***							0.47***	-0.27		
			(0.205)	(0.130)										(0.193)	(0.136)							(0.111)	(0.451)		
lnCap	0.17***	0.20***	0.17***	0.20***	0.19***	0.19***	0.18***	0.19***	0.19***	0.18***	0.19***	0.17***	0.40***	0.16***	0.43***							0.36***	0.37***		
	(0.033)	(0.021)	(0.033)	(0.021)	(0.028)	(0.024)	(0.028)	(0.024)	(0.028)	(0.024)	(0.024)	(0.018)	(0.066)	(0.018)	(0.067)							(0.018)	(0.067)		
lnfirm	0.38***	0.31***	0.40***	0.33***	0.41***	0.28***	0.43***	0.31***	0.33***	0.38***	0.31***	0.33***	0.38***	0.36***	0.37***							0.36***	0.37***		
	(0.043)	(0.035)	(0.043)	(0.035)	(0.042)	(0.035)	(0.042)	(0.035)	(0.042)	(0.035)	(0.034)	(0.027)	(0.108)	(0.027)	(0.109)							(0.027)	(0.109)		
edu	0.16*	-0.02	0.15*	-0.02	0.05	-0.03	0.05	-0.03	0.05	-0.03	0.05	-0.03	0.12	-0.00	0.14							-0.00	0.14		
	(0.083)	(0.043)	(0.084)	(0.044)	(0.058)	(0.051)	(0.058)	(0.052)	(0.040)	(0.159)	(0.040)	(0.159)	(0.040)	(0.159)	(0.040)							(0.040)	(0.157)		
labskill	1.75***	0.85**	1.68***	0.88**	1.42***	1.06***	1.30***	1.14***	1.30***	0.61	1.30***	0.61	1.30***	0.46								1.30***	0.46		
	(0.449)	(0.379)	(0.454)	(0.382)	(0.455)	(0.376)	(0.460)	(0.378)	(0.298)	(1.149)	(0.300)	(1.164)										(0.300)	(1.164)		
expt	-0.09	0.27***	-0.09	0.25***	-0.04	0.26***	-0.05	0.24***	0.16**	-0.31	0.14**	-0.28										0.14**	-0.28		
	(0.114)	(0.093)	(0.115)	(0.093)	(0.116)	(0.087)	(0.117)	(0.087)	(0.071)	(0.286)	(0.071)	(0.288)										(0.071)	(0.288)		
Constant	-4.36***	-3.32***	-4.37***	-3.33***	-3.74***	-3.25***	-3.73***	-3.28***	-3.27***	-5.56***	-3.27***	-5.73***										-3.27***	-5.73***		
	(0.439)	(0.217)	(0.443)	(0.218)	(0.294)	(0.267)	(0.298)	(0.268)	(0.208)	(0.800)	(0.210)	(0.807)										(0.210)	(0.807)		
Observations	3059	4560	3042	4526	3885	3734	3851	3717	6536	1083	6491	1077										6491	1077		
Pseudo R2	0.220	0.214	0.220	0.212	0.258	0.165	0.256	0.166	0.180	0.417	0.181	0.418										0.181	0.418		

Robust standard errors in parentheses.

Note: Following the PCI definition, we define Transparency as the level of a transparent business environment and equitable business information; Informal costs as informal charges; Time costs as time requirements for bureaucratic procedures and inspections; Fair competition as minimal crowding out of private activity from policy biases toward state, foreign, or connected firms; Proactive and creative provincial leadership in solving firms' problems; Fair and effective legal procedure for dispute resolution and maintaining law and order.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

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